# *US EPA-APPROVED*

# TOTAL MAXIMUM DAILY LOAD (TMDL)

**FOR THE**

# MAINSTEM OF THE CANADIAN RIVER

## [FROM TEXAS TO COLORADO]

# AND SELECT TRIBUTARY STREAMS

## NOVEMBER 21, 2011

* The SWQB has prepared separate TMDL bundles for other surface waters in the Canadian Headwaters, Mora River, and Cimarron River subwatersheds (available at: http://www.nmenv.state.nm.us/swqb/Cimarron/ and http://www.nmenv.state.nm.us/swqb/Canadian).

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***COVER PHOTO**: Ute Creek at NM Highway 102 near Bueyeros, NM, September 28, 2005.*

# LIST OF ABBREVIATIONS

| | |
|---|---|
| 4Q3 | 4-Day, 3-year low-flow frequency |
| BMP | Best management practices |
| CFR | Code of Federal Regulations |
| cfs | Cubic feet per second |
| CGP | Construction general storm water permit |
| CWA | Clean Water Act |
| $^oC$ | Degrees Celsius |
| $^oF$ | Degrees Fahrenheit |
| HUC | Hydrologic unit code |
| $j/m^2/s$ | Joules per square meter per second |
| $km^2$ | Square kilometers |
| LA | Load allocation |
| lbs/day | Pounds per day |
| mgd | Million gallons per day |
| mg/L | Milligrams per Liter |
| $mi^2$ | Square miles |
| mL | Milliliters |
| MOS | Margin of safety |
| MOU | Memorandum of Understanding |
| MS4 | Municipal separate storm sewer system |
| MSGP | Multi-sector general storm water permit |
| NM | New Mexico |
| NMAC | New Mexico Administrative Code |
| NMED | New Mexico Environment Department |
| NPDES | National Pollutant Discharge Elimination System |
| NPS | Nonpoint source |
| QAPP | Quality Assurance Project Plan |
| RFP | Request for proposal |
| SEE | Standard Error of the Estimate |
| SSTEMP | Stream Segment Temperature Model |
| SWPPP | Storm water pollution prevention plan |
| SWQB | Surface Water Quality Bureau |
| TMDL | Total Maximum Daily Load |
| USEPA | U.S. Environmental Protection Agency |
| USFS | U.S. Forest Service |
| USGS | U.S. Geological Survey |
| WLA | Waste load allocation |
| WQCC | Water Quality Control Commission |
| WQS | Water quality standards (NMAC 20.6.4 as amended through August 31, 2007) |
| WBP | Watershed-based plan |
| WWTP | Wastewater treatment plant |

# EXECUTIVE SUMMARY

Section 303(d) of the Federal Clean Water Act requires states to develop Total Maximum Daily Load (TMDL) management plans for water bodies determined to be water quality limited. A TMDL documents the amount of a pollutant a waterbody can assimilate without violating a state's water quality standards. It also allocates that load capacity to known point sources and nonpoint sources at a given flow. TMDLs are defined in 40 Code of Federal Regulations Part 130 as the sum of the individual Waste Load Allocations (WLAs) for point sources and Load Allocations (LAs) for nonpoint source and background conditions. TMDLs also include a Margin of Safety (MOS).

The Surface Water Quality Bureau (SWQB) conducted a water quality survey of the Canadian River basin of northeastern New Mexico in 2006. Water quality monitoring stations were located within the Canadian River watershed to evaluate the impact of tributary streams and ambient water quality conditions. As a result of assessing data generated during this monitoring effort, impairment determinations of New Mexico water quality standards include the following:

- DISSOLVED BORON in Revuelto Creek (Canadian River to headwaters);
- BACTERIA (*E. coli*) in the Canadian River (Conchas River to Mora River), Canadian River (Ute Reservoir to Conchas Reservoir), and Pajarito Creek (Canadian River to headwaters); and,
- PLANT NUTRIENTS in the Canadian River (Cimarron River to Colorado border), Pajarito Creek (Canadian River to headwaters), Uña de Gato Creek (Chicorica Creek to Highway 64), and Uña de Gato Creek (Highway 64 to headwaters).

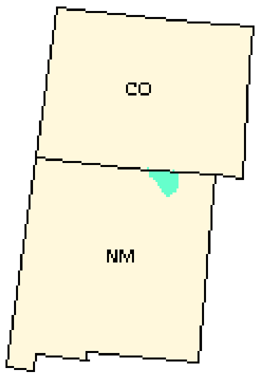
This TMDL document addresses the above noted impairments as summarized in the tables below. The SWQB has prepared separate TMDL bundles for other surface waters in the Canadian Headwaters, Mora River, and Cimarron River subwatersheds.

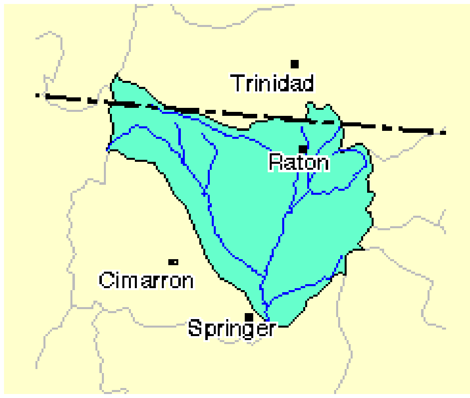
The 2006 study identified other potential water quality impairments which are not addressed in this document. Additional data needs for verification of those impairments are being identified and data collection will follow. If these impairments are verified, subsequent TMDLs will be prepared in a separate TMDL document.

The SWQB's Monitoring and Assessment Section will collect water quality data during the next rotational cycle. The next scheduled monitoring date for the Canadian Watershed is 2015, at which time TMDL targets will be re-examined and potentially revised as this document is considered to be an evolving management plan. In the event that new data indicate that the targets used in this analysis are not appropriate and/or if new standards are adopted, the load capacity will be adjusted accordingly. When water quality standards have been achieved, the reach will be moved to the appropriate category in the Integrated Report.

The SWQB's Watershed Protection Section will continue to work with watershed groups to develop Watershed-Based Plans to implement strategies that attempt to correct the water quality impairments detailed in this document. Implementation of items detailed in the Watershed-Based Plans will be done with participation of all interested and affected parties.

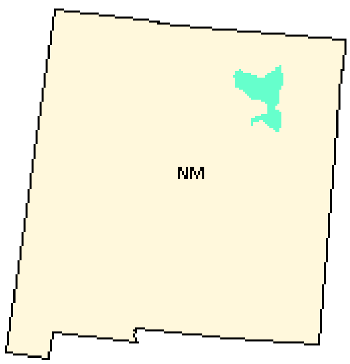
## TOTAL MAXIMUM DAILY LOAD FOR CANADIAN RIVER (CIMARRON RIVER TO COLORADO BORDER)

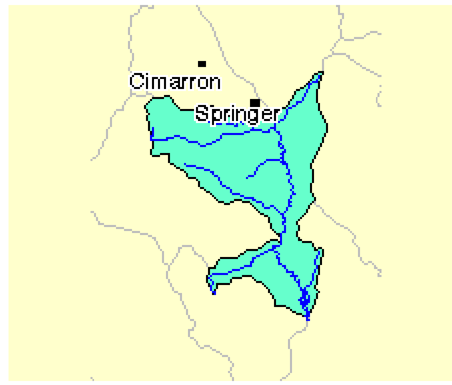



| | |
|---|---|
| New Mexico Standards Segment | 20.6.4.305 |
| Waterbody Identifier | NM-2305.A_200 formerly known as NM-CR1-10000 |
| Segment Length | 99.31 miles |
| Parameters of Concern | Plant Nutrients |
| Uses Affected | Marginal Warmwater Aquatic Life |
| Geographic Location | Canadian Headwaters USGS Hydrologic Unit Code 11080001 |
| Scope/size of Watershed | 2,850 square miles |
| Land Type | Southwestern Tablelands (Ecoregion 26); Southern Rockies (21) |
| Land Use/Cover | 61% Rangeland; 38% Forest; <1% Agriculture; <1% Urban |
| Probable Sources | Animal feeding operations (NPS); flow alterations from water diversions; rangeland grazing |
| Land Management | 93% Private; 6% State; <1% US Fish and Wildlife Service; <1% US Forest Service; <1% Bureau of Land Management |
| IR Category | 5/5C |
| Priority Ranking | High |
| TMDL for: | |
| Plant Nutrients: | **WLA + LA + MOS = TMDL** |
| Total Phosphorus | **0 + 0.098 + 0.017 = 0.115 lbs/day** |
| Total Nitrogen | **0 + 1.47 + 0.260 = 1.73 lbs/day** |

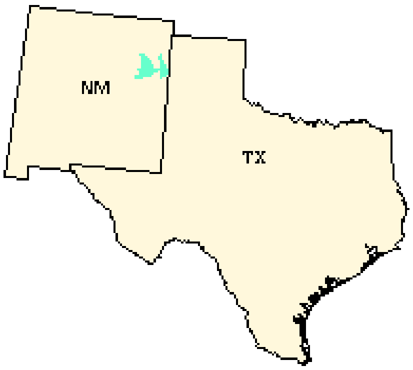
# TOTAL MAXIMUM DAILY LOAD FOR
# CANADIAN RIVER (CONCHAS RIVER TO MORA RIVER)

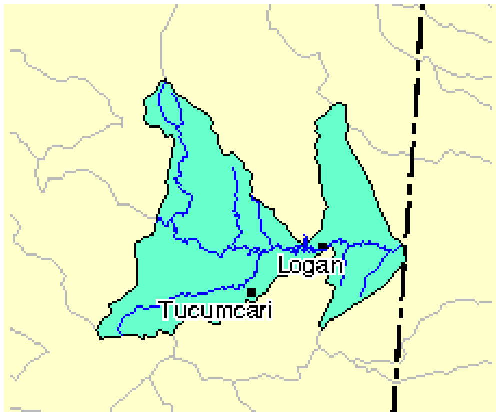



| | |
|---|---|
| New Mexico Standards Segment | 20.6.4.305 |
| Waterbody Identifier | NM-2305.A_000 formerly known as NM-CR3-10000 |
| Segment Length | 36.56 miles |
| Parameters of Concern | *E. coli* |
| Uses Affected | Primary Contact |
| Geographic Location | Upper Canadian USGS Hydrologic Unit Code 11080003 |
| Scope/size of Watershed | 6,388 square miles |
| Land Type | Southwestern Tablelands (Ecoregion 26) |
| Land Use/Cover | 67% Rangeland; 32% Forest; <1% Agriculture; <1% Urban |
| Probable Sources | Drought-related impacts; rangeland grazing; avian sources (waterfowl and/or other); wildlife (other than waterfowl) |
| Land Management | 85% Private; 8% State; 4% US Forest Service; 1% State Game and Fish; 1% Bureau of Land Management; <1% US Fish and Wildlife Service |
| IR Category | 5/5A |
| Pripity Ranking | High |
| TMDL for:<br>*E. coli* | **WLA + LA + MOS = TMDL**<br>**0 + $1.41\times10^{11}$ + $2.49\times10^{10}$ = $1.66\times10^{11}$ cfu/day** |

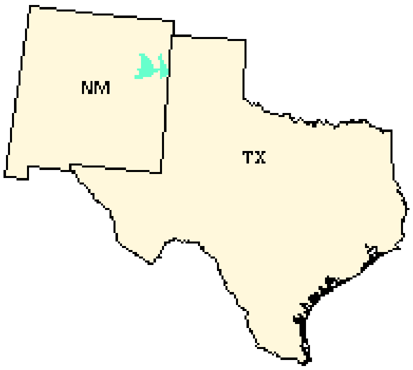
# TOTAL MAXIMUM DAILY LOAD FOR
# CANADIAN RIVER (UTE RESERVOIR TO CONCHAS RESERVOIR)

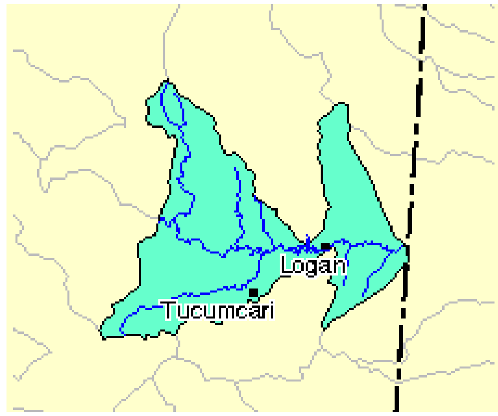



| | |
|---|---|
| New Mexico Standards Segment | 20.6.4.303 |
| Waterbody Identifier | NM-2303_00 formerly known as NM-CR6-20000 |
| Segment Length | 63.34 miles |
| Parameters of Concern | *E. coli* |
| Uses Affected | Primary Contact |
| Geographic Location | Upper Canadian–Ute Reservoir USGS Hydrologic Unit Code 11080006 |
| Scope/size of Watershed | 11,141 square miles |
| Land Type | Southwestern Tablelands (Ecoregion 26) |
| Land Use/Cover | 76% Rangeland; 22% Forest; 1% Agriculture; <1% Urban |
| Probable Sources | Drought-related impacts; rangeland grazing; avian sources (waterfowl and/or other); wildlife other than waterfowl; flow alterations from water diversions |
| Land Management | 87% Private; 8% State; 3% US Forest Service; 1% Bureau of Land Management; <1% State Game and Fish; <1% US Fish and Wildlife |
| IR Category | 5/5C |
| Priority Ranking | High |
| TMDL for:<br>*E. coli* | **WLA + LA + MOS = TMDL**<br>**0 + $2.56x10^9$ + $4.51x10^8$ = $3.01x10^9$ cfu/day** |

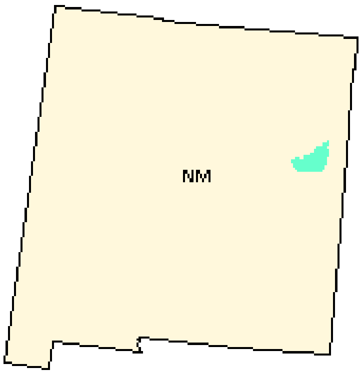
# TOTAL MAXIMUM DAILY LOAD FOR
# PAJARITO CREEK (CANADIAN RIVER TO HEADWATERS)

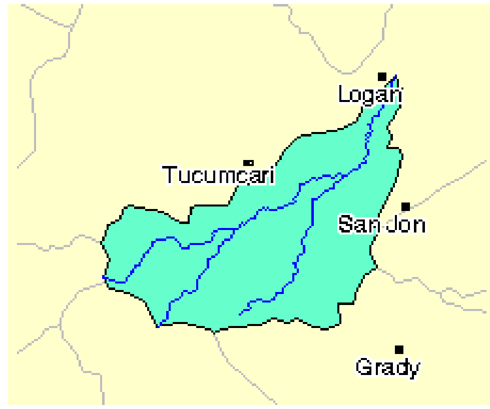



| | |
|---|---|
| New Mexico Standards Segment | 20.6.4.303 |
| Waterbody Identifier | NM-2303_10 formerly known as NM-CR6-20100 |
| Segment Length | 55.88 miles |
| Parameters of Concern | *E. coli*; Plant Nutrients |
| Uses Affected | Primary Contact; Marginal Warmwater Aquatic Life |
| Geographic Location | Upper Canadian–Ute Reservoir USGS Hydrologic Unit Code 11080006 |
| Scope/size of Watershed | 538 square miles |
| Land Type | Southwestern Tablelands (Ecoregion 26) |
| Land Use/Cover | 96% Rangeland; 3% Agriculture; <1% Urban; <1% Forest |
| Probable Sources | Avian sources (waterfowl and/or other); wildlife (other than waterfowl); drought-related impacts; livestock (grazing or feeding operations); municipal point source dischargers, rangeland grazing |
| Land Management | 84% Private; 15% State; 1% Bureau of Land Management |
| IR Category | 5/5A |
| Priority Ranking | High |
| TMDL for: | **WLA + LA + MOS = TMDL** |
| *E. coli* | **$4.39\times10^9$ + $5.31\times10^8$ + $9.36\times10^7$ = $5.01\times10^9$ cfu/day** |
| Plant Nutrients: | |
| Total Phosphorus | **0.230 + 0.028 + 0.005 = 0.263 lbs/day** |
| Total Nitrogen | **3.45 + 0.416 + 0.074 = 3.94 lbs/day** |

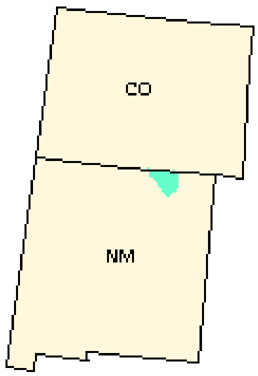
**TOTAL MAXIMUM DAILY LOAD FOR**
**REVUELTO CREEK (CANADIAN RIVER TO HEADWATERS)**

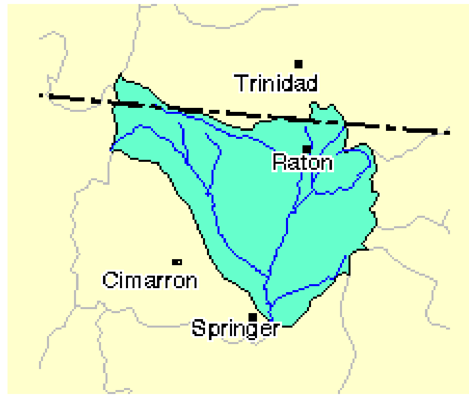



| | |
|---|---|
| New Mexico Standards Segment | 20.6.4.301 |
| Waterbody Identifier | NM-2301_10 formerly known as NM-CR8-10000 |
| Segment Length | 20.8 miles |
| Parameters of Concern | Boron |
| Uses Affected | Marginal Warmwater Aquatic Life – Chronic Life |
| Geographic Location | Revuelto USGS Hydrologic Unit Code 11080008 |
| Scope/size of Watershed | 806 square miles |
| Land Type | Southwestern Tablelands (Ecoregion 26) |
| Land Use/Cover | 90% Rangeland; 8% Agriculture; 1% Barren; <1% Forest; <1% Urban |
| Probable Sources | Drought-related impacts; irrigated crop production; natural sources |
| Land Management | 90% Private; 10% State; <1% Bureau of Land Management |
| IR Category | 5/5A |
| Priority Ranking | High |
| TMDL for:<br>Dissolved Boron | **WLA + LA + MOS = TMDL**<br>**0 + 1.11 + 0.197 = 1.31 lbs/day** |

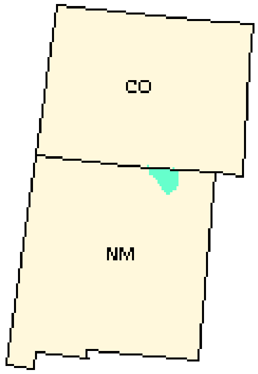
**TOTAL MAXIMUM DAILY LOAD FOR**
**UÑA DE GATO CREEK (CHICORICA CREEK TO HIGHWAY 64)**

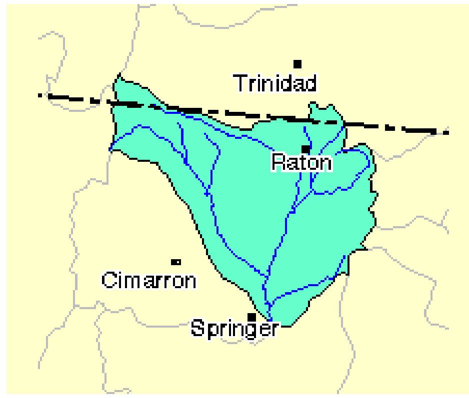



| | |
|---|---|
| New Mexico Standards Segment | 20.6.4.305 |
| Waterbody Identifier | NM-2305.A_254 formerly known as NM-CR1-10320 |
| Segment Length | 10.59 miles |
| Parameters of Concern | Plant Nutrients |
| Uses Affected | Marginal Warmwater Aquatic Life |
| Geographic Location | Canadian Headwaters USGS Hydrologic Unit Code 11080001 |
| Scope/size of Watershed | 126 square miles |
| Land Type | Southwestern Tablelands (Ecoregion 26) |
| Land Use/Cover | 77% Rangeland; 21% Forest; 1% Agriculture; <1% Urban |
| Probable Sources | Drought-related impacts; rangeland grazing; wildlife (other than waterfowl) |
| Land Management | 92% Private; 8% State; <1% Bureau of Land Management |
| IR Category | 5/5A |
| Priority Ranking | High |
| TMDL for: | **WLA + LA + MOS = TMDL** |
| Plant Nutrients: | |
| Total Phosphorus | **0 + 0.041 + 0.007 = 0.048 lbs/day** |
| Total Nitrogen | **0 + 0.606 + 0.107 = 0.713 lbs/day** |

**TOTAL MAXIMUM DAILY LOAD FOR**
**UÑA DE GATO (HIGHWAY 64 TO HEADWATERS)**




| | |
|---|---|
| New Mexico Standards Segment | 20.6.4.305 |
| Waterbody Identifier | NM-2305.A_030 |
| Segment Length | 21.01 miles |
| Parameters of Concern | Plant Nutrients |
| Uses Affected | Marginal Warmwater Aquatic Life |
| Geographic Location | Canadian Headwaters USGS Hydrologic Unit Code 11080001 |
| Scope/size of Watershed | 97 square miles |
| Land Type | Southwestern Tablelands (Ecoregion 26); Southern Rockies (21) |
| Land Use/Cover | 67% Rangeland; 31% Forest; 1% Agriculture; <1% Urban |
| Probable Sources | Drought-related impacts; rangeland grazing; wildlife (other than waterfowl) |
| Land Management | 95% Private; 5% State |
| IR Category | 5/5A |
| Priority Ranking | High |
| TMDL for: | **WLA + LA + MOS = TMDL** |
| Plant Nutrients: | |
| Total Phosphorus | **0 + 0.041 + 0.007 = 0.048 lbs/day** |
| Total Nitrogen | **0 + 0.606 + 0.107 = 0.713 lbs/day** |

# 1.0 INTRODUCTION

Under Section 303 of the federal Clean Water Act (CWA), states establish water quality standards, which are submitted and subject to the approval of the U.S. Environmental Protection Agency (USEPA). Under Section 303(d)(1) of the CWA, states are required to develop a list of waters within a state that are impaired and establish a total maximum daily load (TMDL) for each impairment. A TMDL is defined as "*a written plan and analysis established to ensure that a waterbody will attain and maintain water quality standard including consideration of existing pollutant loads and reasonably foreseeable increases in pollutant loads*" (USEPA 1999). A TMDL documents the amount of a pollutant a waterbody can assimilate without violating a state's water quality standards. It also allocates that load capacity to known point sources and nonpoint sources at a given flow. TMDLs are defined in 40 Code of Federal Regulations (CFR) Part 130 as the sum of the individual Waste Load Allocations (WLAs) for point sources and Load Allocations (LAs) for nonpoint sources and natural background conditions." TMDLs also include a margin of safety (MOS). This document provides TMDLs for assessment units within the Canadian River watershed that have been determined to be impaired based on a comparison of measured concentrations and conditions with numeric water quality criteria or with numeric translators for narrative standards.

This document is divided into several sections. Section 2.0 provides background information on the location and history of the Canadian River watershed, provides applicable water quality standards for the assessment units addressed in this document, and briefly discusses the water quality survey that was conducted in the Canadian River watershed in 2006. Section 3.0 presents the TMDLs developed for dissolved boron, Section 4.0 provides *E. coli* TMDLs, and Section 5.0 contains nutrient TMDLs. Pursuant to CWA Section 106(e)(1), Section 6.0 provides a monitoring plan in which methods, systems, and procedures for data collection and analysis are discussed. Section 7.0 discusses implementation of TMDLs (phase two) and the relationship between TMDLs and Watershed-Based Plans (WBPs). Section 8.0 discusses assurance, Section 9.0 public participation in the TMDL process, and Section 10.0 provides references.

# 2.0 CANADIAN WATERSHED CHARACTERISTICS

The Canadian River basin was intensively sampled by the Surface Water Quality Bureau (SWQB) from March to October 2006. The Canadian River basin includes perennial reaches of the Canadian River from the Texas/New Mexico Border to Colorado/New Mexico, as well as tributaries that enter the Canadian River along those perennial reaches. Surface water quality monitoring stations were selected to characterize water quality of the stream reaches.

## 2.1 Location Description

The Canadian River watershed (US Geological Survey [USGS] Hydrologic Unit Codes [HUC] 11080001, 11080002, 11080003, 11080004, 11080005, 11080006, 11080007, 11080008, and 11090101) is part of the vast drainage system of the Arkansas River. The Canadian River watershed encompasses about one-sixth the land area of New Mexico or about 1720 square miles (1.1 million acres). Canadian River tributaries flow east and southeast from their origins on the east slopes of the Sangre de Cristo Mountains of northern New Mexico and southern Colorado. As it traverses the Great Plains in a southerly and then easterly direction, several perennial tributaries, including the Vermejo, Cimarron, Mora, and Conchas Rivers join the Canadian River before it exits New Mexico toward Texas near Logan, New Mexico. The Canadian River flows generally east through the Texas panhandle into Oklahoma, where it drains a sizeable portion of that state before reaching its confluence with the Arkansas River just west of Fort Smith, Arkansas. The entire drainage system encompasses approximately 47,700 square miles in the three states.

The Canadian River is a braided, meandering system fed by the numerous streams and creeks and drains semi-deserts, plains, prairies, forests, and mountains. The Canadian River watershed in New Mexico is located in Omernick Level III Ecoregion 21 (Southern Rockies) in the headwaters and Level III Ecoregion 26 (Southwestern Tablelands) in the lowlands. The elevation range for the various sampling sites in the survey was 3517’ to 7119’ above sea level. As presented in Figure 2.1, land use along the mainstem of the Canadian River is approximately 73% rangeland; 25% forest; 1% agriculture; and <1% urban.

Historic and current land uses in the watershed include farming, ranching, recreation, and municipal related activities (Raton, Springer, Tucumcari, Logan). Much of the land ownership adjacent to the river is private with the exceptions of Maxwell National Wildlife Refuge, Fort Union National Monument near Watrous, and national forest land at higher elevations in the headwaters. The State of New Mexico also owns and manages tracts of public lands in the eastern portions of the watershed (Figure 2.2).

Several species within this watershed are listed as either threatened or endangered by both State and Federal agencies. Endangered species include the Southern redbelly dace (*Phoxinus erythrogaster*), Southwestern willow flycatcher (*Empidonax traillii extimus*), Least tern (*Sterna antillarum*), Black-footed ferret (*Mustela nigripes*), and Holy Ghost ipomopsis (*Holy Ghost ipomopsis*). Threatened species include the Arkansas River shiner (*Notropis girardi*), Suckermouth minnow (*Phenacobius mirabilis*), Arkansas River speckled chub (*Macrhybopsis tetranema*), Bald eagle (*Haliaeetus leucocephalus*), Mexican spotted owl (*Strix occidentalis lucida*), and Piping plover (*Charadrius melodus*).

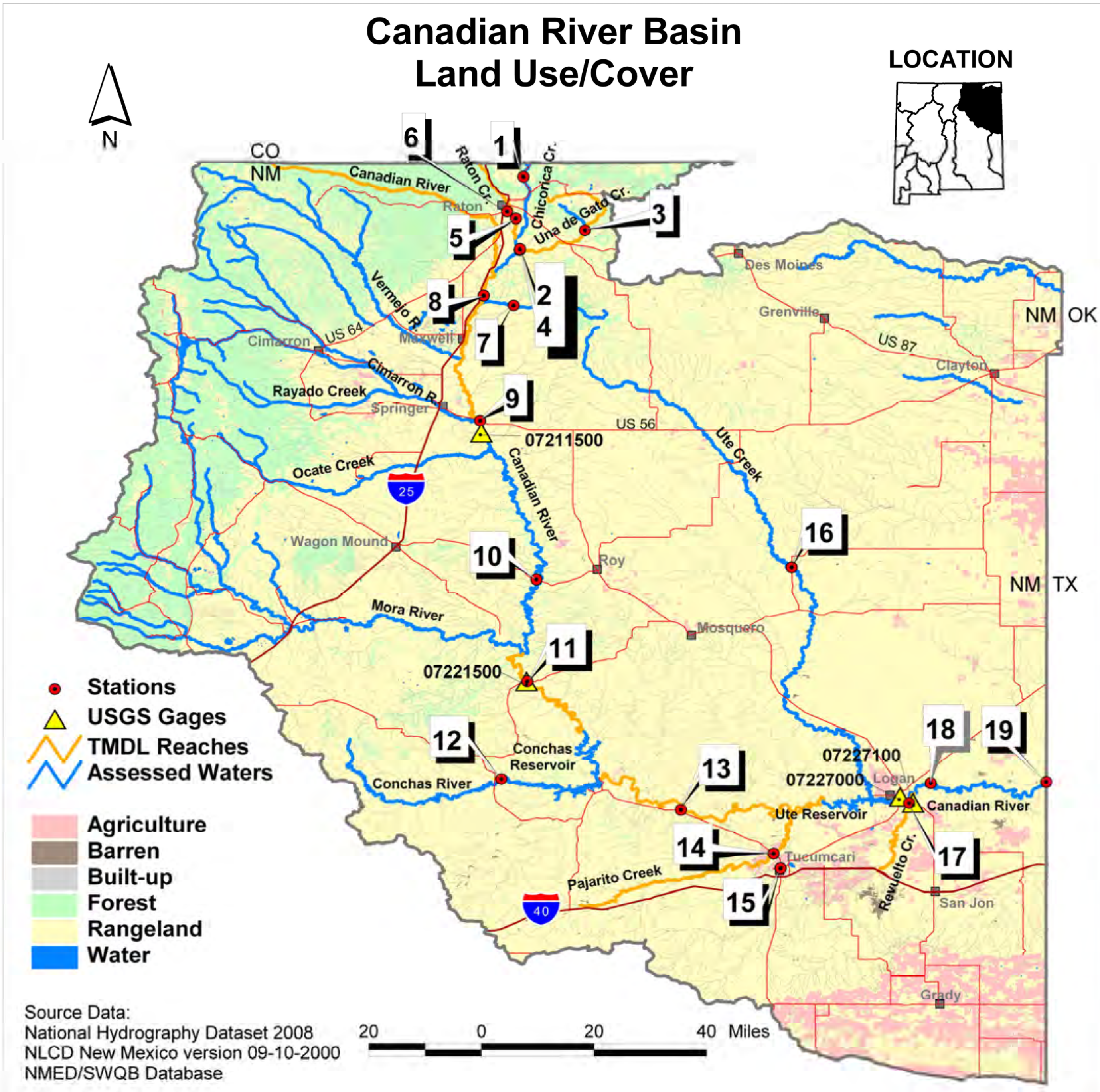



**Figure 2.1** **Land use and sampling stations in the Canadian River Watershed.**
See Table 2.1 for station information.

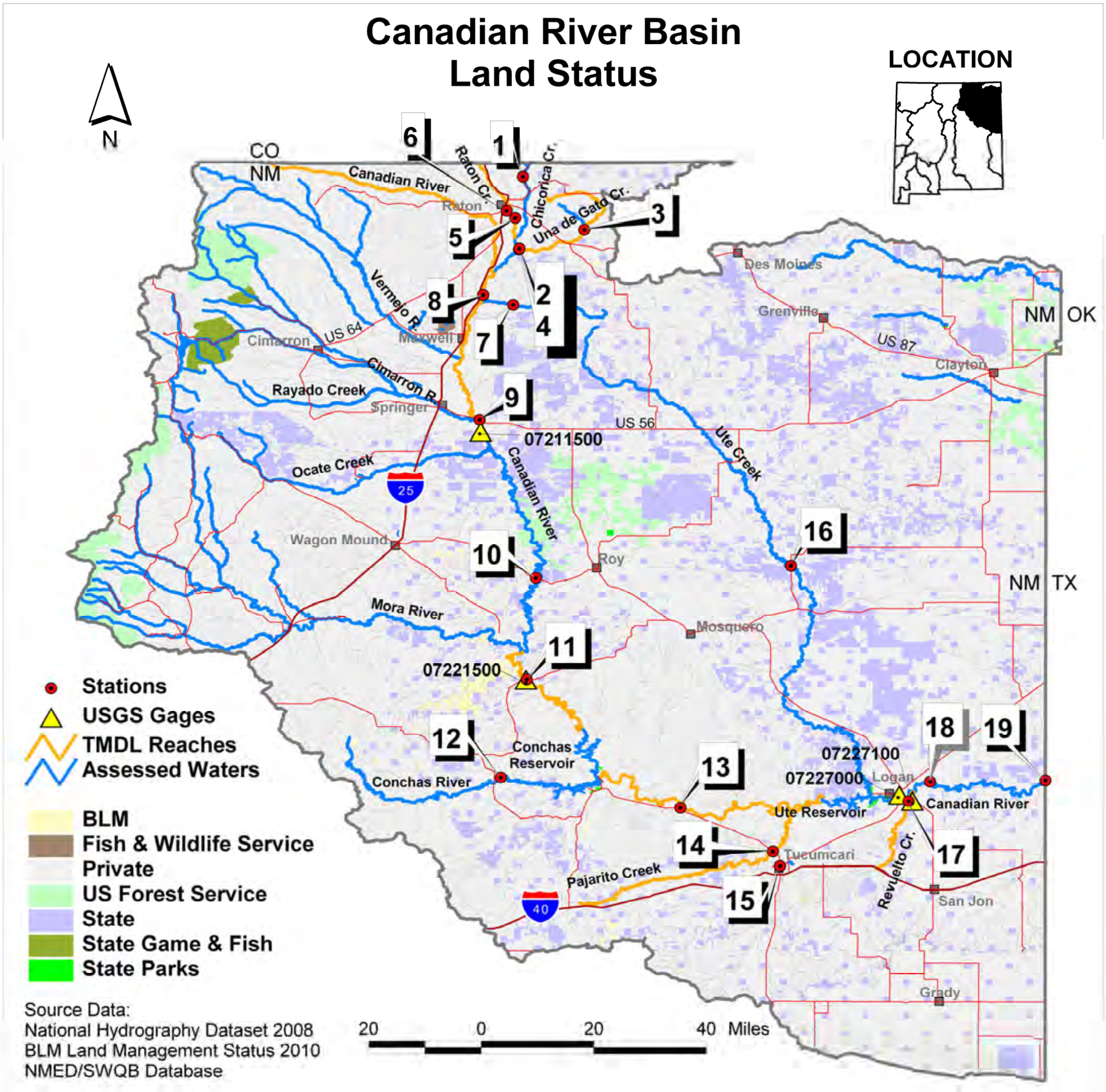



**Figure 2.2 Land management and sampling stations in the Canadian River Watershed**

## 2.2 Geology and Land Use

The laterally extensive pediments, topographically inverted basalt-capped mesas, and stripped structural surfaces of the Las Vegas Plateau of northeastern New Mexico gradually slope to the southeast away from the eastern flank of the Sangre de Cristo Mountains, which represent both the southern Rocky Mountain front in New Mexico as well as the eastern flank of the Rio Grande rift. The Canadian River has carved a deep bedrock canyon into the gently warped strata of the Las Vegas Plateau in response to a complex interaction of rock-uplift processes (characterized by domes, arches, and basins) and downstream base level fall caused by evaporite dissolution (Wisniewski & Pazzaglia 2002). The Las Vegas Plateau terminates to the south in a 250–300 meter high, embayed line of cliffs known as the Canadian escarpment. The canyon is deepest (~400 m) and widest (~1.5 km) where it breaches the escarpment north of Conchas Lake near Sabinoso, New Mexico.

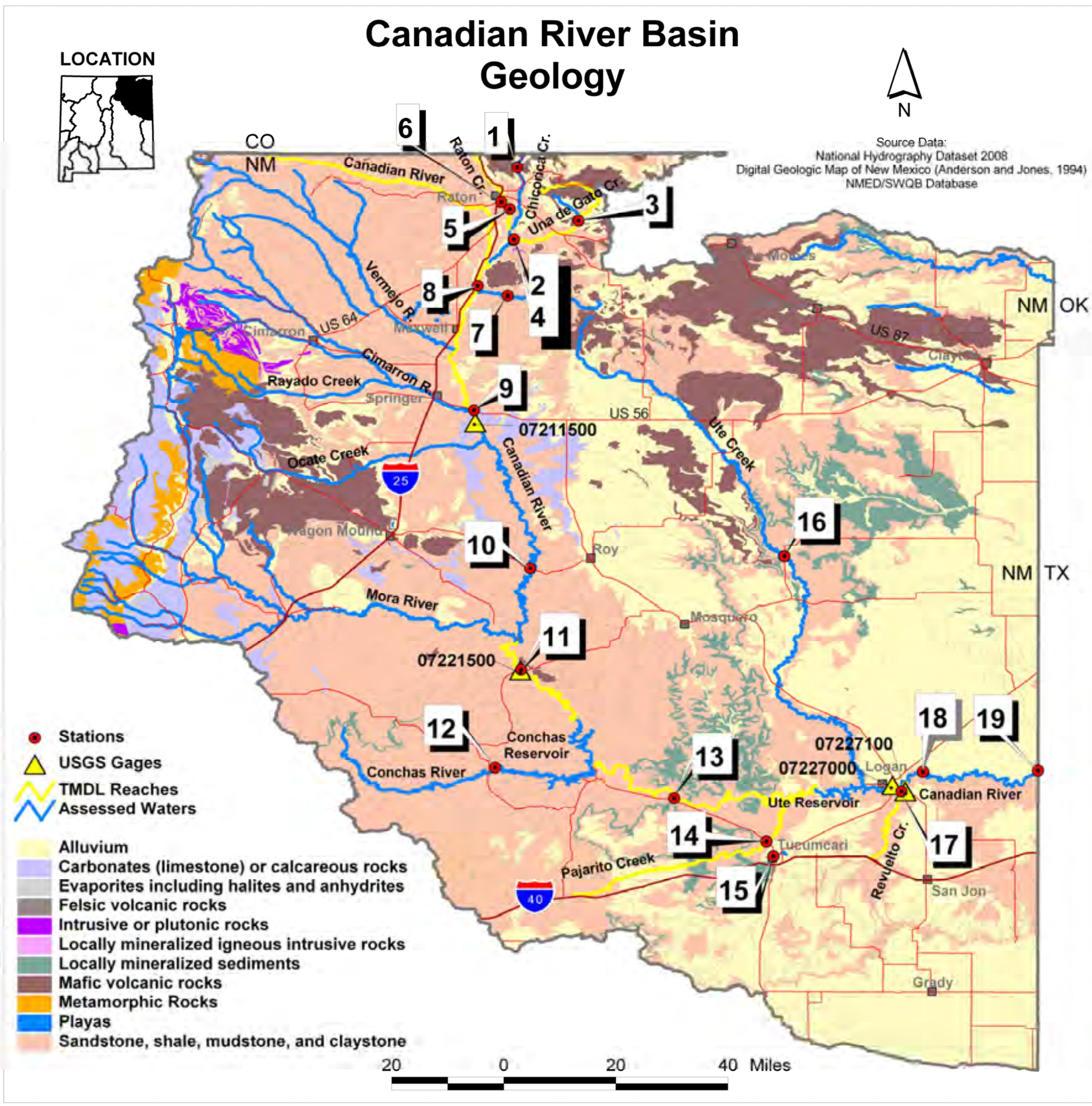



**Figure 2.3 Geologic map of the Canadian River Watershed and sampling stations**

## 2.3 Water Quality Standards and Designated Uses

Water quality standards (WQS) for all assessment units in this document are set forth in sections, 20.6.4.301, 20.6.4.303, and 20.6.4.305 of the *Standards for Interstate and Intrastate Surface Waters*, 20.6.4 New Mexico Administrative Code, as amended through January 14, 2011 (NMAC 2011). These standards have been approved by the WQCC and are awaiting approval from EPA for Clean Water Act purposes.

**20.6.4.301 CANADIAN RIVER BASIN - The main stem of the Canadian River from the New Mexico – Texas line upstream to Ute dam, and any flow that enters the main stem from Revuelto Creek.**
**Designated Uses**: irrigation, marginal warmwater aquatic life, livestock watering, wildlife habitat and primary contact.

**20.6.4.303 CANADIAN RIVER BASIN - The main stem of the Canadian River from the headwaters of Ute Reservoir upstream to Conchas Dam, the perennial reaches of Pajarito and Ute Creeks and their perennial tributaries.**
**Designated Uses**: irrigation, marginal warmwater aquatic life, livestock watering, wildlife habitat and primary contact.

**20.6.4.305 CANADIAN RIVER BASIN - The main stem of the Canadian River from the headwaters of Conchas Reservoir upstream to the New Mexico – Colorado line, perennial reaches of the Conchas River,… and perennial reaches of Raton, Chicorica (except Lake Maloya and Lake Alice) and Uña de Gato Creeks.**
**Designated Uses**: irrigation, marginal warmwater aquatic life, livestock watering, wildlife habitat and primary contact.

The numeric criteria identified in these sections are used for assessing waters for use attainability. Section 20.6.4.900 NMAC provides a list of water chemistry analytes for which SWQB tests and identifies numeric criteria for specific designated uses. In addition, waters are assessed against the narrative criteria identified in Section 20.6.4.13 NMAC, including bottom sediments and suspended or settleable solids, plant nutrients, and turbidity. The individual water quality criteria or narrative standards are detailed for each parameter in the chapters that follow.

Current impairment listings for the Canadian River watershed and subwatersheds are included in the 2010-2012 State of New Mexico Clean Water Act §303(d)/§305(b) Integrated List (NMED/SWQB 2010a). The Integrated List is a catalog of assessment units (AUs) throughout the state with a summary of their current status as assessed/not assessed or impaired/not impaired. Once a stream AU is identified as impaired, a TMDL guidance document is developed for that segment with guidelines for stream restoration. Target values for TMDLs are determined based on 1) applicable numeric criteria or appropriate numeric translator to a narrative standard, 2) the degree of experience in applying various management practices to reduce a specific pollutant's loading, and 3) the ability to easily monitor and produce quantifiable and reproducible results. AU names and WQS have changed over the years and the history of these individual changes is tracked in the Record of Decision document associated with the 2010-2012 Integrated List available on the SWQB website.

New Mexico's antidegradation policy is articulated in Subsection A of 20.6.4.8 NMAC. It mandates that "the level of water quality necessary to protect the existing uses shall be maintained and protected in all surface waters of the state." TMDLs are consistent with this policy because implementation of a TMDL restores water quality so that existing uses are protected and water quality criteria achieved.

## 2.4 Water Quality Sampling

The Canadian River Watershed was sampled by the SWQB in 2006. A brief summary of the survey and the hydrologic conditions during the sample period is provided in the following subsections. A more detailed description can be found in Canadian River Water Quality Survey Summary (NMED/SWQB 2010b).

### 2.4.1 Survey Design

The Monitoring and Assessment Section (MAS) of the SWQB conducted a water quality survey of the Canadian River Watershed between March and November, 2006. The water quality survey in the headwaters and along the mainstem included 19 sampling sites (Figure 2.1 and Table 2.1). Most sites were sampled 8 times, whereas some secondary sites were sampled one to four times. Monitoring these sites enabled an assessment of the cumulative influence of the physical habitat, water sources, and land management activities upstream from the sites. Data results from grab sampling are housed in the SWQB water quality database and were uploaded to USEPA's Storage and Retrieval (STORET) database.

All temperature and chemical/physical sampling and assessment techniques are detailed in the *Quality Assurance Project Plan* (NMED/SWQB 2006) and the SWQB assessment protocols (NMED/SWQB 2007). As a result of the 2006 monitoring effort and subsequent assessment of results, several surface water impairments were determined. Accordingly, these impairments were added to New Mexico's Integrated CWA §303(d)/305(b) List in 2008 (NMED/SWQB 2010a).

**Table 2.1 SWQB 2006 Canadian River watershed sampling stations**

| MAP # | STATION NAME | STATION ID |
|---|---|---|
| 1 | Chicorica Creek above Lake Alice | 04Chicor034.4 |
| 2 | Chicorica Creek below Uña de Gato Creek | 04Chicor010.9 |
| 3 | Uña de Gato Creek below T O dam | 04UnaGat020.9 |
| 4 | Uña de Gato Creek above Chicorica Creek | 04UnaGat000.1 |
| 5 | Raton Creek 5 miles abv Chicorica Creek | 04RatonC007.8 |
| 6 | Raton WWTP | NM0020273 |
| 7 | Tinaja Creek above Canadian River | 04Tinaja010.1 |
| 8 | Canadian River at Tinaja | 04Canadi402.9 |
| 9 | Canadian River above Cimarron River at NM 56 | 04Canadi352.7 |

| MAP # | STATION NAME | STATION ID |
|---|---|---|
| 10 | Canadian River at State HWY 120 Bridge | 06Canadi274.8 |
| 11 | Canadian River at NM 419 near Sanchez | 06Canadi232.6 |
| 12 | Conchas River at gage on NM 104 | 08Concha025.1 |
| 13 | Canadian River at NM 104 at milemarker 88 | 09Canadi144.5 |
| 14 | Pajarito Creek at NM 104 | 09Pajari020.0 |
| 15 | Tucumcari WWTP | NM0020711 |
| 16 | Ute Creek above Highway 102 near Bueyeros | 10UteCre104.3 |
| 17 | Revuelto Creek at NM 469 above Canadian R | 11Revuel003.9 |
| 18 | Canadian River below Ute Dam at the Gravel Pit | 09Canadi049.2 |
| 19 | Canadian River above NM/TX State Line | 09Canadi001.2 |

### 2.4.2 Hydrologic Conditions

There are four active USGS gaging stations in the Canadian River: the Canadian River near Taylor Springs, the Canadian River near Sanchez, the Canadian River at Logan, and Revuelto Creek near Logan. The annual mean streamflows for the Canadian River over the periods of record are 73.0 cubic feet per second (cfs) near the headwaters (Taylor Springs), 169.5 cfs near Sanchez, and 35.8 cfs near the Texas border (Logan) (Figures 2.4 – 2.6). Streamflow near the Texas border is considerably lower than the upstream flows because it is controlled by releases from Ute Reservoir. The annual mean streamflow for Revuelto Creek based on the period of record is 41.1 cfs (Figure 2.7).

During the 2006 watershed survey, daily flows in the Canadian River were below average most of the year (except during the monsoon season – July through September) with annual mean streamflows of 17.2 cfs near Taylor Springs, 69.4 cfs near Sanchez, and 29.8 cfs at Logan approximately 75%, 60%, and 15% below "normal," respectively. Likewise, daily flows in Revuelto Creek were below average and erratic for most of the year with flows peaking during the monsoon season (July through September). Revuelto Creek had an annual mean streamflow of 19.3 cfs approximately 50% below "normal".

As stated in the Assessment Protocol (NMED/SWQB 2011), data collected during all flow conditions, including low flow conditions (i.e., flows below 4-day, 3-year flows [4Q3]), will be used to determine designated use attainment status during the assessment process. For the purpose of assessing designated use attainment in ambient surface waters, WQS apply at all times under all flow conditions.

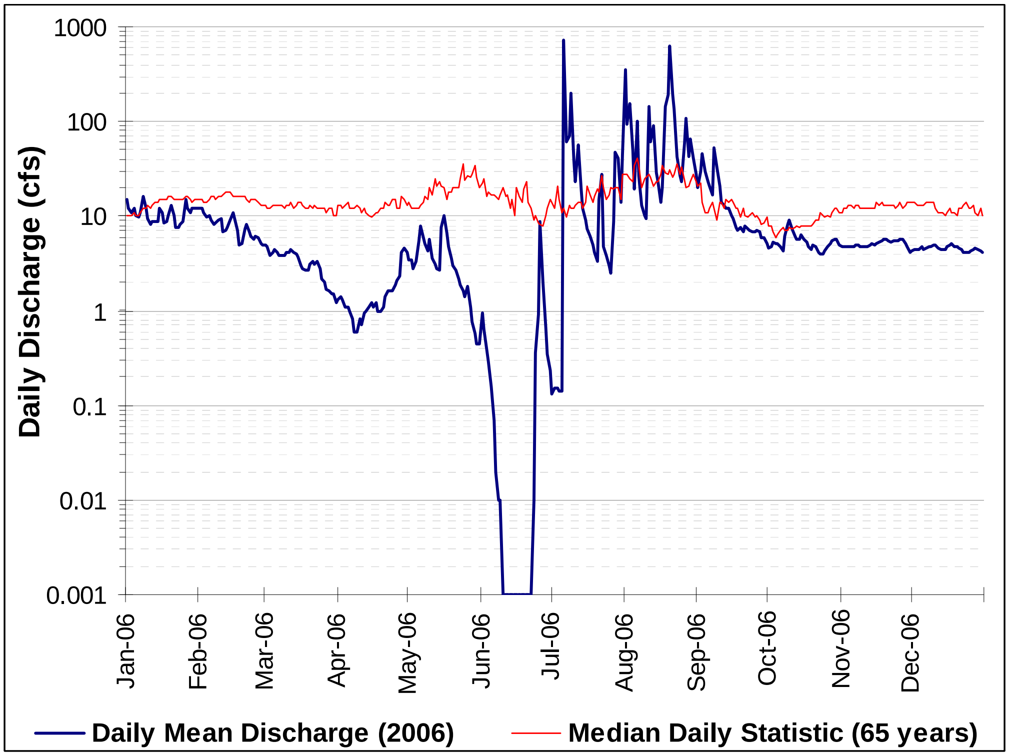



**Figure 2.4 USGS 07211500 Canadian River near Taylor Springs, NM**

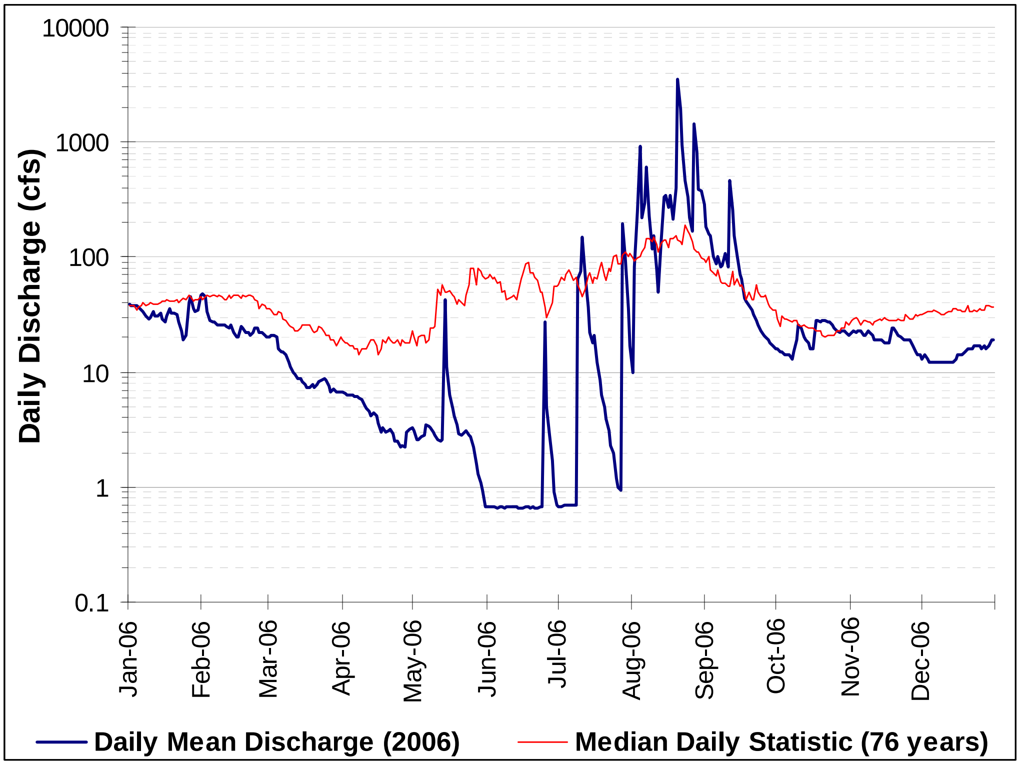



**Figure 2.5 USGS 07221500 Canadian River near Sanchez, NM**

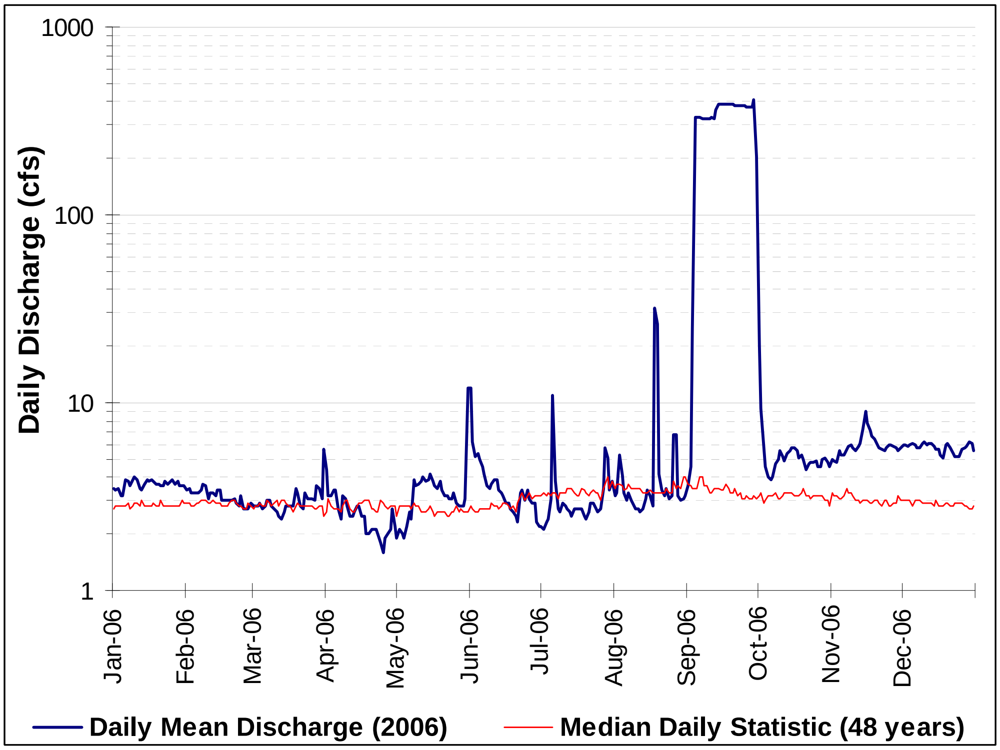



**Figure 2.6 USGS 07227000 Canadian River near at Logan, NM**
*****flow dependent on dam releases from Ute Reservoir*****

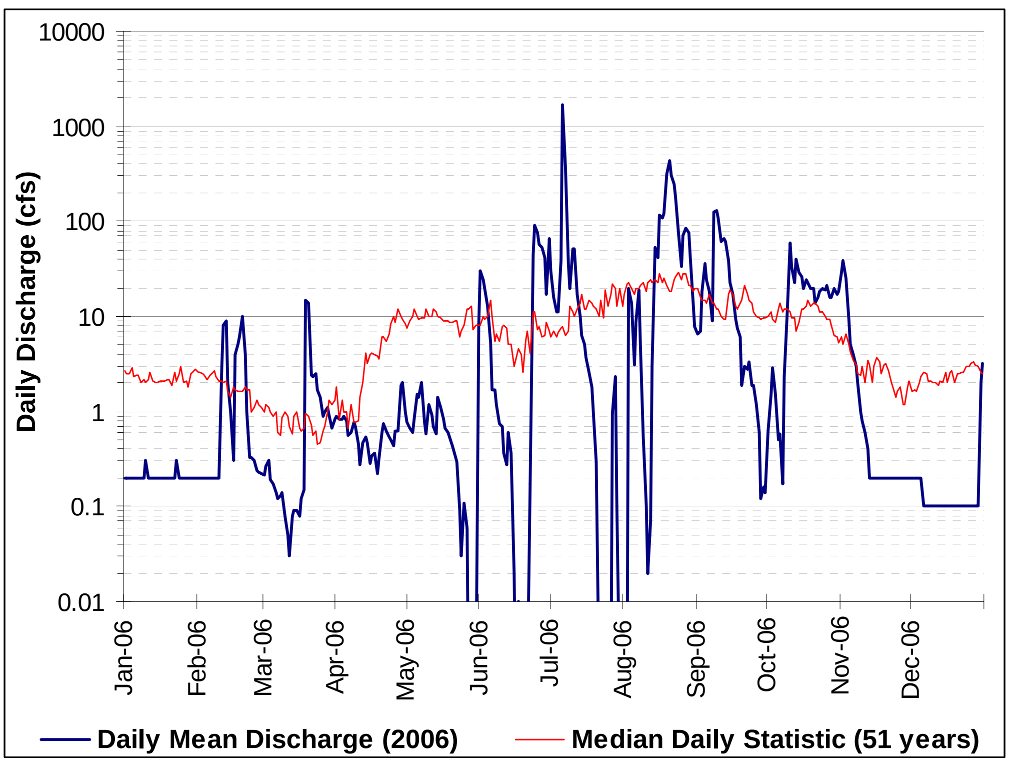



**Figure 2.7 USGS 07227100 Revuelto Creek near Logan, NM**

# 3.0 BORON

Assessment of data from the 2006 SWQB water quality survey in the Canadian River watershed identified exceedences of the New Mexico water quality standards for boron in:

- Revuelto Creek (Canadian River to headwaters)

Consequently, this waterbody was listed on the Integrated CWA §303(d)/§305(b) list for boron (NMED/SWQB 2010a).

## 3.1 Target Loading Capacity

According to the New Mexico water quality standards (20.6.4.900 NMAC), the dissolved boron criteria are 750 µg/L for irrigation and 5,000 µg/L for livestock watering. Exceedences are presented in Table 3.1.

Boron is a naturally occurring element widely distributed in the earth's crust, soils, and minerals. In water boron is usually found as boric acid. High concentrations of boron are common for some volcanic spring waters and boron may also enter the air, water, and land from wind-blown dust or runoff and leaching. Boron is an essential plant nutrient, although high soil concentrations of boron may also be toxic to plants. Additionally, sodium perborate serves as a source of active oxygen in many detergents, laundry detergents, cleaning products, laundry bleaches, and some tooth bleaching formulas.

**Table 3.1 Dissolved boron exceedences**

| Assessment Unit | Designated Use Affected | Associated Criterion (µg/L) | Exceedence Ratio (# exceedences / total # samples) |
|---|---|---|---|
| Revuelto Creek (Canadian River to headwaters) | IRR | 750 | 2/34 |

Notes: IRR = Irrigation
µg/L = micrograms per liter

## 3.2 Flow

Boron concentrations can vary as a function of flow; therefore TMDLs are calculated at a specific flow. The target flow value used to calculate the TMDL for this stream reach was obtained using a 4-day, 3-year low-flow frequency (4Q3) regression model. The 4Q3 is the annual lowest 4 consecutive day flow that occurs with a frequency of at least once every 3 years. When available, USGS gages are used to estimate flow.

The 4Q3 flow for the Revuelto Creek (Canadian River to headwaters) was evaluated using USGS gage data. Revuelto Creek near Logan, NM (USGS Gage 07227100) is located in the assessment unit (AU). The 4Q3 was estimated using the USGS A193 calculation for Log Pearson Type III distribution through DFLOW software, Version 3.1b (USEPA 2006a). DFLOW 3.1b is a Windows-based tool developed to estimate user selected design stream flows for low flow analysis.

A climatic year starting April 1 of the prior year and ending March 31 is often used when examining critical low flow conditions in the United States. This choice reduces the likelihood of splitting low flow periods - typically found in the summer or fall - across different years and thereby affecting the results of Log Pearson Type III analysis of series of annual low flows. A different climatic year or shorter season may be used if low flow periods occur at other times of the year or overlap the boundaries of the climatic year.

The calculated 4Q3 using gage data and DFLOW software is:

- Revuelto Creek (Canadian River to headwaters) = 0 cfs

Because the critical flow based on DFLOW software is zero, the 4Q3 derivation for this TMDL will be based on analysis methods described by Waltemeyer (2002). In this analysis, two regression equations for estimating 4Q3 were developed based on physiographic regions of NM (i.e., statewide and mountainous regions above 7,500 feet in elevation). The following statewide regression equation is based on data from 50 gaging stations with non-zero discharge (Waltemeyer 2002):

$$4Q3 \quad = \quad 1.2856 \times 10^{-4}\ DA^{0.42}\ P_w^{\ 3.16} \qquad \text{(Eq. 3-1)}$$

where,

4Q3 = Four-day, three-year low-flow frequency (cfs)
DA = Drainage area ($mi^2$)
$P_w$ = Average basin mean winter precipitation (inches)

The average standard error of estimate (SEE) and coefficient of determination are 126 and 48 percent, respectively, for this regression equation (Waltemeyer 2002). The 4Q3 for Revuelto Creek was estimated using the statewide regression equation (Eq. 3-1) because the mean elevation for this assessment unit is below 7,500 feet in elevation (Table 3.2).

**Table 3.2 Calculation of 4Q3 low-flow frequency for Revuleto Creek**

| Assessment Unit | Average Elevation (ft.) | Drainage Area ($mi^2$) | Mean Winter Precipitation (in.) | 4Q3 (cfs) |
|---|---|---|---|---|
| Revuelto Creek (Canadian River to headwaters) | 4245 | 806 | 4.88 | 0.32 |

The 4Q3 value for Revuelto Creek was converted from cubic feet per second (cfs) to units of million gallons per day (mgd) as follows:

$$0.32\,\frac{ft^3}{\sec}\times 1{,}728\,\frac{in^3}{ft^3}\times 0.004329\,\frac{gal}{in^3}\times 86{,}400\,\frac{\sec}{day}\times 10^{-6} = 0.21 mgd$$

It is important to remember that the TMDL itself is a value calculated at a defined critical condition, and is calculated as part of a planning process designed to achieve water quality standards. Since flows vary throughout the year in these systems, the actual load at any given time will vary based on the changing flow.

## 3.3 Calculations

A target loading capacity, or total maximum daily load (TMDL), for boron is calculated based on a critical flow, the current water quality criterion, and a conversion factor (0.00834) that is used to convert µg/L units to lbs/day (Equation 3-2). The result is shown in Table 3.3.

*Critical flow (mgd) x Criterion (µg/L) x 0.00834 = TMDL* (Eq. 3-2)

**Table 3.3 Calculation of target loads for dissolved boron**

| Assessment Unit | 4Q3 Flow (mgd) | Dissolved Boron[1] (µg/L) | Conversion Factor | TMDL (lbs/day) |
|---|---|---|---|---|
| Revuelto Creek (Canadian River to headwaters) | 0.21 | 750 | 0.00834 | 1.31 |

Notes: [1] target values are based on the most conservative applicable criterion.

The measured load for boron was similarly calculated. The arithmetic mean of the data used to determine the impairment was substituted for the criterion in Equation 3-3. The same conversion factor of 0.00834 was used. Results are presented in Table 3.4.

**Table 3.4 Calculation of measured loads for dissolved boron**

| Assessment Unit | 4Q3 Flow (mgd) | Dissolved Boron Arithmetic Mean[1] (µg/L) | Conversion Factor | Measured Load (lbs/day) |
|---|---|---|---|---|
| Revuelto Creek (Canadian River to headwaters) | 0.21 | 423 | 0.00834 | 0.74 |

**Notes**: [1] dissolved boron concentration is the arithmetic mean of observed values

## 3.4 Waste Load Allocations and Load Allocations

### 3.4.1 Waste Load Allocation

There are no facilities with an NPDES permit in Revuelto Creek (Canadian River to headwaters). There are no individually permitted Municipal Separate Storm Sewer System (MS4) storm water permits in this assessment unit. Because there are no individually permitted MS4 storm water permits in this assessment unit, the TMDL does not include a specific wasteload allocation (WLA) for storm water discharges for Revuelto Creek.

Excess boron levels may be a component of some (primarily construction) storm water discharges covered under General NPDES permits, so the load from these discharges should be addressed. In contrast to discharges from other industrial storm water and individual process wastewater permitted facilities, storm water discharges from construction activities are transient because they occur mainly during the construction itself, and then only during storm events. Coverage under the NPDES construction general storm water permit (CGP) requires preparation of a Storm Water Pollution Prevention Plan (SWPPP) that includes identification and control of all pollutants associated with the construction activities to minimize impacts to water quality. In addition, the current CGP also includes state specific requirements to implement best management practices (BMPs) that are designed to prevent to the maximum extent practicable, an increase in sediment, or a parameter that addresses sediment (e.g., total suspended solids, turbidity, siltation, stream bottom deposits, bacteria etc.) and water velocity during and after construction compared to pre-construction conditions. In this case, compliance with a SWPPP that meets the requirements of the CGP is generally assumed to be consistent with this TMDL.

Other industrial storm water facilities are generally covered under the current NPDES Multi-Sector General Storm Water Permit (MSGP). This permit also requires preparation of an SWPPP that includes identification and control of all pollutants associated with the industrial activities to minimize impacts to water quality. In addition, the current MSGP also includes specific requirements to further limit (or eliminate) pollutant loading to water quality impaired/water quality limited waters from facilities where there is a reasonable potential to contain pollutants for which the receiving water is impaired. In this case, compliance with a SWPPP that meets the requirements of the MSGP is generally assumed to be consistent with this TMDL. Individual WLAs for the General Permits were not possible to calculate at this time in this watershed using available tools. Loads that are in compliance with the General Permits from facilities covered are therefore currently calculated as part of the load allocation.

### 3.4.2 Load Allocation

In order to calculate the load allocation (LA), the WLA and margin of safety (MOS) were subtracted from the target capacity TMDL following **Equation 3-3**:

$$WLA + LA + MOS = TMDL \qquad \text{(Eq. 3-3)}$$

The MOS is estimated to be 15 percent of the TMDL calculated in Table 3.3. Results are presented in Table 3.5. Additional details on the MOS are presented in Section 3.7.

**Table 3.5 TMDL for dissolved boron**

| Assessment Unit | WLA (lbs/day) | LA (lbs/day) | MOS (15%) (lbs/day) | TMDL (lbs/day) |
|---|---|---|---|---|
| Revuelto Creek (Canadian River to headwaters) | 0 | 1.11 | 0.197 | 1.31 |

The extensive data collection and analyses necessary to determine background boron loads for Revuelto Creek were beyond the resources available for this study. It is therefore assumed that a portion of the LA is made up of natural background loads.

The load reduction necessary to meet the target load was calculated to be the difference between the calculated TMDL (Table 3.3) and the measured load (Table 3.4), and is shown in Table 3.6. This load reduction table is presented for informational purposes only and provides the reader with an estimation of the degree of impairment, or the magnitude of restoration efforts that would be required to improve water quality. In this instance, there were 2 of 34 exceedences of boron in Revuelto Creek. Both exceedences occurred during low flow, but there were also 32 other measurements across a range of flow conditions that did not exceed the standards. Thus, the TMDL was written to recognize these violations of water quality standards but the boron impairment may be relatively easy to fix with minimal restoration effort.

**Table 3.6 Calculation of load reduction for dissolved boron**

| Assessment Unit | Target Load[(a)] (lbs/day) | Measured Load[(b)] (lbs/day) | Load Reduction (lbs/day) | Percent Reduction[(c)] |
|---|---|---|---|---|
| Revuelto Creek (Canadian River to headwaters) | 1.11 | 0.74 | 0 | 0% |

Note: The MOS is not included in the load reduction calculations because it is a set aside value which accounts for any uncertainty or variability in TMDL calculations and therefore should not be subtracted from the measured load.

*(a)* Target Load = TMDL – MOS

*(b)* Measured load from Table 3.4.

*(c)* Percent reduction is the percent the existing measured load must be reduced to achieve the TMDL, and is calculated as follows: (Measured Load – Target Load) / Measured Load x 100

It is important to note that the WLA and LA are estimates based on a specific flow condition (i.e., 4Q3 in this case). Under differing hydrologic conditions, the loads will change. For this reason the load allocations given here are less meaningful than are the relative percent reductions. Successful implementation of this TMDL will be determined based on achieving the current water quality standards.

## 3.5 Identification and Description of Pollutant Source(s)

Probable sources of boron for Revuelto Creek will be evaluated, refined, and changed as necessary through the Watershed-Based Plans (WBP) process. Probable sources that may be contributing to the observed load are displayed in Table 3.7:

**Table 3.7 Pollutant source summary for Boron**

| Assessment Unit | Pollutant Sources | Magnitude[(a)] (lbs/day) | Probable Sources[(b)] (% from each) |
|---|---|---|---|
| Revuelto Creek (Canadian River to headwaters) | Point: | 0 | 0% |
| | Nonpoint: | | 100% Drought-Related Impacts; Irrigated Crop Production; Natural Sources |

**Notes**:
*(a)* Measured Load.
*(b)* From the 2010-2012 Integrated CWA 303(d)/305(b) list (NMED/SWQB 2010a). This list of probable sources is based on staff observation and known land use activities in the watershed. These sources are not confirmed nor quantified at this time.

## 3.6 Linkage of Water Quality and Pollutant Sources

SWQB fieldwork includes an assessment of the probable sources of impairment. The Probable Sources field sheet sample in Appendix A provides an approach for a visual analysis of potential pollutant sources along an impaired reach. Although this procedure is subjective, SWQB feels that it provides the best available information for the identification of probable sources of impairment in this watershed. Table 3.6 displays probable sources of impairments along the reach as determined by field reconnaissance and assessment.

Boron is an essential micronutrient for plants, but different plant species require different boron levels for optimum growth. Boron plays several roles within the plant cell: in cell division, in the metabolism, and in the cell membrane. As a result, boron (in the form of borates) occurs naturally in fruits, nuts, and vegetables. Boron enters the environment mainly through natural processes such as weathering and, to a lesser extent, through anthropogenic sources such as borate-containing fertilizers and the burning of domestic waste and wood fuel since boron is present in many plants.

In plants, there is only a narrow margin between boron deficiency and excess boron uptake leading to toxicity. Boron excesses usually occur in soil solution, i.e. the water found in the soil containing soluble material, from geologically young deposits, arid soils and soils derived from marine sediments. It also occurs in soils contaminated by human activities, such as releases from sewage outfalls. Irrigation water containing boron is one of the main sources of high boron levels leading to toxicity on agricultural land.

## 3.7 Margin of Safety

TMDLs should reflect a MOS based on the uncertainty or variability in the data, the point and nonpoint source load estimates, and the modeling analysis. The MOS can be expressed either implicitly or explicitly. An implicit MOS is incorporated by making conservative assumptions in the TMDL analysis, such as allocating a conservative load to background sources. An explicit MOS is applied by reserving a portion of the TMDL and not allocating it to any other sources.

For this boron TMDL, the margin of safety was developed using a combination of conservative assumptions and explicit recognition of potential errors. Therefore, this margin of safety is the sum of the following two elements:

- *Conservative Assumptions*

  Using the 4Q3 critical low flow "worst case scenario" to calculate the allowable loads.

- *Explicit recognition of potential errors*

  A level of uncertainty exists in sampling nonpoint sources of pollution. Accordingly, an explicit MOS of **10 percent** was assigned to this TMDL.

  Flow was based on the estimation of the 4Q3 for ungaged streams and compared to actual flows and cross-sectional information taken in the field. Techniques used for measuring flow in water have a ± 5 percent precision. Accordingly, an explicit MOS of **5 percent** was assigned to this TMDL.

  **Therefore, based on the potential errors described above an explicit MOS of 15% of the LA was assigned to the boron TMDL.**

## 3.8 Consideration of Seasonal Variation

Federal regulations (40 CFR §130.7(c)(1)) require that TMDLs take into consideration seasonal variation in watershed conditions and pollutant loading. During the 2006 water quality survey, boron exceedences and elevated boron concentrations typically occurred during lower flows (<10 cfs). It is possible the criterion may be exceeded under a low flow condition when there is insufficient dilution. Evaluation of seasonal variability for potential nonpoint sources is difficult due to limited available data. Data used in the calculation of this TMDL were collected during the spring, summer, and fall of 2006 in order to ensure coverage of any potential seasonal variation in the system.

## 3.9 Future Growth

Growth estimates by county are available from the New Mexico Bureau of Business and Economic Research. These estimates project growth to the year 2035. Growth estimates for Quay County project a less than 1% growth rate through 2035. Quay County includes several small agricultural communities such as Tucumcari, Logan, Wheatland, and Quay.

Boron loading is due to diffuse nonpoint sources. Estimates of future growth are not anticipated to lead to a significant increase in boron concentrations that cannot be controlled with best management practices (BMPs) in this watershed. However, it is imperative that BMPs continue to be utilized and improved upon in this watershed while continuing to improve agricultural practices, road conditions and grazing allotments and adhering to SWPPP requirements related to construction and industrial activities covered under the general permit.

# 4.0 BACTERIA

Assessment of the data from the 2006 SWQB water quality survey in the Canadian River watershed identified exceedences of the New Mexico water quality standards for *E. coli* bacteria in:

- Canadian River (Ute Reservoir to Conchas Reservoir)
- Canadian River (Conchas River to Mora River)
- Pajarito Creek (Canadian River to headwaters)

As a result, these assessment units were listed on the Integrated CWA §303(d)/§305(b) List with *E. coli* as a pollutant of concern (NMED/SWQB 2010a). When water quality standards have been achieved, the reach will be moved to the appropriate category on the Clean Water Act Integrated §303(d)/§305(b) List of assessed waters.

## 4.1 Target Loading Capacity

For this TMDL document, target values for bacteria are based on the reduction in bacteria necessary to achieve the numeric criterion:

> *20.6.4.900 NMAC Subsection D – <u>Primary Contact</u>: The monthly geometric mean of E. coli bacteria 126 cfu/100 mL or less; single sample 410 cfu/100 mL or less.*

The presence of *E. coli* bacteria is an indicator of the possible presence of other pathogens that may limit beneficial uses and present human health concerns. Exceedences for each assessment unit are presented in Table 4.1.

**Table 4.1 *E. coli* exceedences**

| Assessment Unit | Designated Use Affected | Associated Criterion* (cfu/100mL) | Exceedence Ratio (# exceedences / total # samples) |
|---|---|---|---|
| Canadian River (Ute Reservoir to Conchas Reservoir) | PC | 410 | 2/5 |
| Canadian River (Conchas River to Mora River) | PC | 410 | 2/14 |
| Pajarito Creek (Canadian River to headwaters) | PC | 410 | 3/7 |

Notes: * = single sample criterion
PC = Primary Contact
cfu = colony forming units
mL = milliliters

## 4.2 Flow

TMDLs are calculated at a specific flow and bacteria concentrations can vary as a function of flow. SWQB determined streamflow during the 2006 sampling season either by using the active USGS gage network or by taking direct in-stream flow measurements utilizing standard procedures. Water quality standard exceedences for all impaired reaches except the Canadian River (Conchas River to Mora River) occurred *only* during lower flows. Therefore, for these reaches, the critical flow value used to calculate the TMDLs was obtained using a 4-day, 3-year low-flow frequency (4Q3) regression model. The 4Q3 is the annual lowest 4 consecutive day flow that occurs with a frequency of at least once every 3 years.

The 4Q3 flow for the Canadian River (Ute Reservoir to Conchas Reservoir) is based on USGS gage data from an inactive gage below Conchas Dam. Canadian River below Conchas (USGS Gage 07224500) is located in the assessment unit (AU) and has a period of record from 1943 to 1972. Conchas Dam was completed in 1939 so using this gage data as an estimate of current flow seems reasonable since streamflow is dependent on releases from the dam. The 4Q3 for this AU was estimated using the USGS A193 calculation for Log Pearson Type III distribution through DFLOW software, Version 3.1b (USEPA 2006a). DFLOW 3.1b is a Windows-based tool developed to estimate user selected design stream flows for low flow analysis.

A climatic year starting April 1 of the prior year and ending March 31 is often used when examining critical low flow conditions in the United States. This choice reduces the likelihood of splitting low flow periods - typically found in the summer or fall - across different years and thereby affecting the results of Log Pearson Type III analysis of series of annual low flows. A different climatic year or shorter season may be used if low flow periods occur at other times of the year or overlap the boundaries of the climatic year.

The calculated 4Q3 using gage data and DFLOW software is:

- Canadian River (Ute Reservoir to Conchas Reservoir) = 0.98 cfs

It is often necessary to estimate a critical flow for a portion of a watershed where there is no active USGS flow gage. 4Q3 derivations for ungaged streams in the Canadian Watershed were based on analysis methods described by Waltemeyer (2002). In Waltemeyer's analysis, two regression equations for estimating 4Q3 were developed based on physiographic regions of NM (i.e., statewide and mountainous regions above 7,500 feet in elevation). The following statewide regression equation is based on data from 50 gaging stations with non-zero discharge (Waltemeyer 2002):

$$4Q3 = 1.2856 \times 10^{-4} \, DA^{0.42} \, P_w^{\,3.16} \qquad \text{(Eq. 4-1)}$$

where,

4Q3 = Four-day, three-year low-flow frequency (cfs)
DA = Drainage area ($mi^2$)
$P_w$ = Average basin mean winter precipitation (inches)

The average standard error of estimate (SEE) and coefficient of determination are 126 and 48 percent, respectively, for this regression equation (Waltemeyer 2002). The 4Q3 for Pajarito Creek was estimated using the statewide regression equation (Eq. 4-1) because the mean elevations for this assessment unit was below 7,500 feet in elevation (Table 4.4).

**Table 4.4 Calculation of 4Q3 low-flow frequencies**

| Assessment Unit | Average Elevation (ft.) | Drainage Area ($mi^2$) | Mean Winter Precipitation (in.) | 4Q3 (cfs) |
|---|---|---|---|---|
| Pajarito Creek (Canadian River to headwaters) | 4534 | 538 | 4.49 | 0.21 |

For the Canadian River (Conchas River to Mora River), water quality standard exceedences *only* occurred during higher flows. Therefore, the critical streamflow value for this portion of the Canadian River is the lowest streamflow at which the *E. coli* standard is exceeded, or the expected flow at which *E. coli* is equal to 126 cfu/100 mL. Figure 4.1 depicts the relationship between *E. coli* and streamflow for the Canadian River near Sanchez, NM.

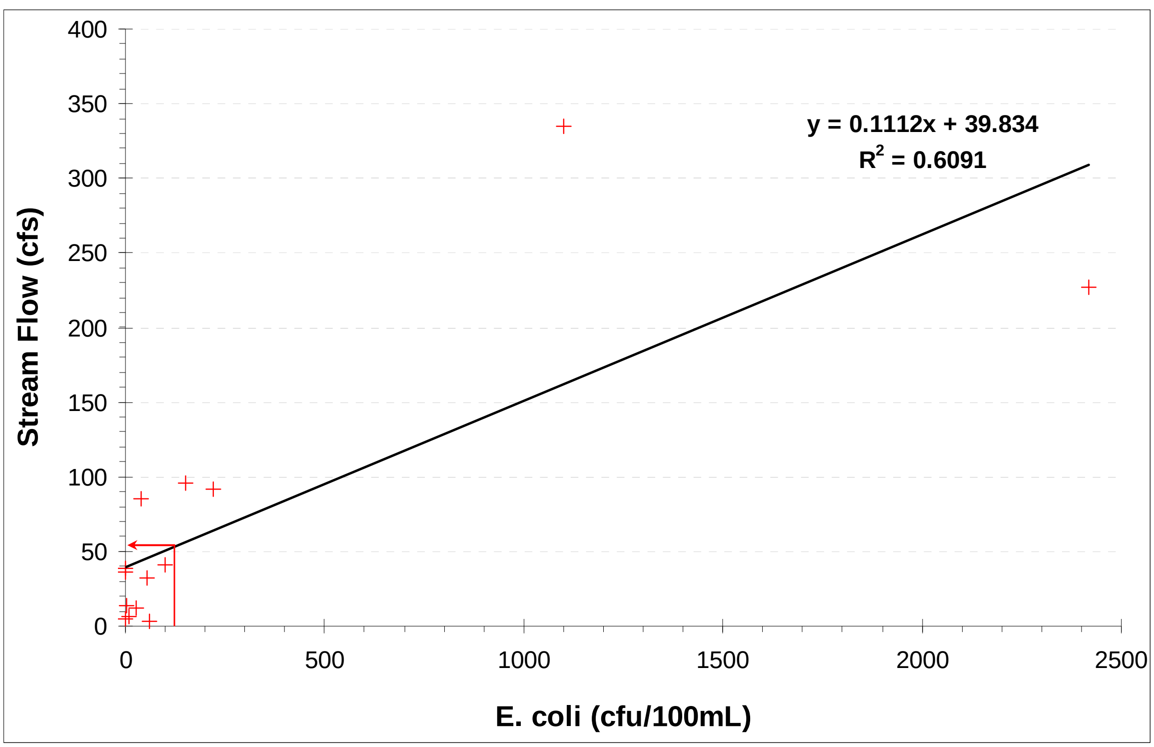



**Figure 4.1 Relationship between *E. coli* and streamflow – Canadian River near Sanchez**

The critical flow for the Canadian River (Conchas River to Mora River) was calculated using the relationship between bacteria and streamflow presented in Figure 4.1. Using the bacteria – stream flow relationship and a standard of 126 cfu/100mL for the x-variable, the estimated critical flow is:

- Canadian River (Conchas River to Mora River) =
  (0.1112 x 126 cfu/100mL) + 39.834 ≅ 53.8 cfs

The critical streamflow value for the Canadian River was converted from cubic feet per second (cfs) to units of million gallons per day (mgd) as follows:

$$53.8\,\frac{ft^3}{\sec} \times 1{,}728\,\frac{in^3}{ft^3} \times 0.004329\,\frac{gal}{in^3} \times 86{,}400\,\frac{\sec}{day} \times 10^{-6} = 34.8\,mgd$$

Critical flows for the other reaches were converted to mgd using the same formula.

It is important to remember that the TMDL itself is a value calculated at a defined critical condition, and is calculated as part of a planning process designed to achieve water quality standards. Since flows vary throughout the year in these systems, the actual load at any given time will vary based on the changing flow. Management of the load to improve stream water quality should be a goal to be attained. Meeting the calculated TMDL may be a difficult objective.

## 4.3 Calculations

Bacteria standards are expressed as colony forming units (cfu) per unit volume. The *E. coli* criterion used to calculate the allowable stream loads for the impaired assessment units is listed in Table 4.5. Total maximum daily loads (TMDLs), or target loading capacities, for bacteria are calculated based on flow values, water quality standards, and a conversion factor (Equation 4-2). The more conservative monthly geometric mean criterion is utilized in TMDL calculations to provide an implicit MOS. Furthermore, if the single sample criterion was used as a target, the geometric mean criterion may not be achieved.

*C as cfu/100 mL * 1,000 mL/1 L * 1 L/ 0.264 gallons * Q in 1,000,000 gallons/day = cfu/day* (Eq. 4-2)

Where C = the water quality criterion for bacteria,
Q = the critical stream flow in million gallons per day (mgd)

**Table 4.5 Calculation of TMDLs for *E.coli***

| Assessment Unit | Critical Flow (mgd) | *E.coli* geometric mean criterion (cfu/100mL) | Conversion Factor[(a)] | TMDL (cfu/day) |
|---|---|---|---|---|
| Canadian River (Ute Reservoir to Conchas Reservoir) | 0.63 | 126 | $3.79 \times 10^7$ | $3.01 \times 10^9$ |
| Canadian River (Conchas River to Mora River) | 34.8 | 126 | $3.79 \times 10^7$ | $1.66 \times 10^{11}$ |
| Pajarito Creek (Canadian River to headwaters) | 1.05[+] | 126 | $3.79 \times 10^7$ | $5.01 \times 10^9$ |

Notes: + Combined flow based on design flow of Tucumcari WWTP (0.92 mgd) and 4Q3 of stream (0.13 mgd)
*(a)* Based on equation 2.

The measured loads for *E.coli* were similarly calculated. The arithmetic mean of the data used to determine the impairment was substituted for the criterion in Equation 4-2. The same conversion factor was used. Results are presented in Table 4.6.

**Table 4.6 Calculation of measured loads for *E.coli***

| Assessment Unit | Critical Flow (mgd) | *E.coli* Arithmetic Mean[(a)] (cfu/100mL) | Conversion Factor[(b)] | Measured Load (cfu/day) |
|---|---|---|---|---|
| Canadian River (Ute Reservoir to Conchas Reservoir) | 0.63 | 870 | $3.79 \times 10^7$ | $2.08 \times 10^{10}$ |
| Canadian River (Conchas River to Mora River) | 34.8 | 299 | $3.79 \times 10^7$ | $3.94 \times 10^{11}$ |
| Pajarito Creek (Canadian River to headwaters) | 1.05[+] | 785 | $3.79 \times 10^7$ | $3.12 \times 10^{10}$ |

Notes: + Combined flow based on design flow of Tucumcari WWTP (0.92 mgd) and 4Q3 of stream (0.13 mgd)
*(a)* Arithmetic mean of the measured values.
*(b)* Based on equation 2.

## 4.4 Waste Load Allocations and Load Allocations

### 4.4.1 Waste Load Allocation

There are no active point source dischargers on the Canadian River AUs. However, there is an existing point source with an individual NPDES permit in the Pajarito Creek assessment unit. The City of Tucumcari wastewater treatment plant (WWTP) (NM0020711) discharges to Pajarito Creek. Each NPDES-permitted facility that discharges into an impaired reach has a wasteload allocation (WLA) included in this TMDL (Table 4.7).

There are no Municipal Separate Storm Sewer System (MS4) storm water permits in these AUs. However, excess bacteria concentrations may be a component of some storm water discharges covered under general NPDES permits, so the load for these dischargers should addressed.

Storm water discharges from construction activities are transient because they occur mainly during the construction itself, and then only during storm events. Coverage under the National Pollutant Discharge Elimination System (NPDES) Construction General Permit (CGP) for construction sites greater than one acre requires preparation of a Storm Water Pollution Prevention Plan (SWPPP) that includes identification and control of all pollutants associated with the construction activities to minimize impacts to water quality. The current CGP also includes state-specific requirements to implement site-specific interim and permanent stabilization, managerial, and structural solids, erosion, and sediment control Best Management Practices (BMPs) and/or other controls. BMPs are designed to prevent to the maximum extent practicable an increase in sediment load to the water body or an increase in a sediment-related parameter, such as total suspended solids, turbidity, siltation, stream bottom deposits, etc. BMPs also include measures to reduce flow velocity during and after construction compared to pre-construction conditions to assure that waste load allocations (WLAs) or applicable water quality standards, including the antidegradation policy, are met. Compliance with a SWPPP that meets the requirements of the CGP is generally assumed to be consistent with this TMDL.

Storm water discharges from active industrial facilities are generally covered under the current NPDES Multi-Sector General Permit (MSGP). This permit also requires preparation of an SWPPP, which includes specific requirements to limit (or eliminate) pollutant loading associated with the industrial activities in order to minimize impacts to water quality. Compliance with a SWPPP that meets the requirements of the MSGP is generally assumed to be consistent with this TMDL.

It is not possible to calculate individual WLAs for facilities covered by these General Permits at this time using available tools. Loads that are in compliance with the General Permits are therefore currently included as part of the load allocation (LA).

**Table 4.7 Waste Load allocations for *E. coli***

| Assessment Unit | Facility | Design Flow (mgd) | *E. coli* Effluent Limit[(a)] (cfu/100mL) | Conversion Factor[(b)] | Waste Load Allocation (cfu/day) |
|---|---|---|---|---|---|
| Pajarito Creek (Canadian River to headwaters) | **NM0020711** City of Tucumcari WWTP (January 31, 2013 expiration) | 0.92 | 126 | $3.79 \times 10^7$ | $4.39 \times 10^9$ |

Notes: *(a)* Based on current monthly geometric mean WQS for primary contact (20.6.4.900 NMAC).
*(b)* Based on equation 2.

### 4.4.2 Load Allocation

In order to calculate the load allocation (LA), the WLA and margin of safety (MOS) were subtracted from the target capacity TMDL following Equation 4-3:

$$WLA + LA + MOS = TMDL, \text{ or}$$
$$LA = TMDL - WLA - MOS \qquad \text{(Eq. 4-3)}$$

The MOS is estimated to be 10 percent of the target load calculated in Table 4.5. Results are presented in Table 4.8. Additional details on the MOS chosen are presented in Section 4.7.

The extensive data collection and analyses necessary to determine background *E.coli* loads for the Canadian River watershed were beyond the resources available for this study. It is therefore assumed that a portion of the LA is made up of natural background loads.

The load reductions necessary to meet the target loads were calculated to be the difference between the calculated target loads (Table 4.5) and the measured loads (Table 4.6), and are shown in Table 4.9. These load reduction tables are presented for informational purposes only. It is important to note that WLAs and LAs are estimates based on a specific flow condition. Under differing hydrologic conditions, the loads will change. For this reason the load allocations given here are less meaningful than are the relative percent reductions. Successful implementation of this TMDL will be determined based on achieving the *E. coli* standards.

**Table 4.8 TMDL for *E. coli***

| Assessment Unit | WLA (cfu/day) | LA (cfu/day) | MOS (15%)* (cfu/day) | TMDL (cfu/day) |
|---|---|---|---|---|
| Canadian River (Ute Reservoir to Conchas Reservoir) | 0 | $2.56 \times 10^{9}$ | $4.51 \times 10^{8}$ | $3.01 \times 10^{9}$ |
| Canadian River (Conchas River to Mora River) | 0 | $1.41 \times 10^{11}$ | $2.49 \times 10^{10}$ | $1.66 \times 10^{11}$ |
| Pajarito Creek (Canadian River to headwaters) | $4.39 \times 10^{9}$ | $5.31 \times 10^{8}$ | $9.36 \times 10^{7}$ | $5.01 \times 10^{9}$ |

NOTE: * The MOS was calculated as 15% of the nonpoint source Load Allocation, or MOS = 0.15 × (TMDL – WLA).

**Table 4.9 Calculation of load reduction for *E. coli***

| Assessment Unit | Target Load[(a)] (cfu/day) | Measured Load (cfu/day) | Load Reduction (cfu/day) | Percent Reduction[(b)] |
|---|---|---|---|---|
| Canadian River (Ute Reservoir to Conchas Reservoir) | $2.56 \times 10^{9}$ | $2.08 \times 10^{10}$ | $1.82 \times 10^{10}$ | 88% |
| Canadian River (Conchas River to Mora River) | $1.41 \times 10^{11}$ | $3.94 \times 10^{11}$ | $2.53 \times 10^{11}$ | 64% |
| Pajarito Creek (Canadian River to headwaters) | $4.92 \times 10^{9}$ | $3.12 \times 10^{10}$ | $2.63 \times 10^{10}$ | 84% |

Note: The MOS is not included in the load reduction calculations because it is a set aside value which accounts for any uncertainty or variability in TMDL calculations and therefore should not be subtracted from the measured load.

*(a)* Target Load = TMDL - MOS

*(b)* Percent reduction is the percent the existing measured load must be reduced to achieve the Target Load and is calculated as follows: (Measured Load – Target Load) / Measured Load x 100

## 4.5 Identification and Description of Pollutant Source(s)

SWQB fieldwork includes an assessment of the probable sources of impairment (Appendix A). The approach for identifying "Probable Sources of Impairment" was recently modified by SWQB to include additional input from a variety of stakeholders including landowners, watershed groups, and local, state, tribal and federal agencies. Probable Source Sheets are filled out by SWQB staff during watershed surveys and watershed restoration activities. The draft probable source list will be reviewed and modified, as necessary, with watershed group/ stakeholder input during the TMDL public meeting and comment period.

Probable sources that may be contributing to the observed load are displayed in Table 4.10:

**Table 4.10 Pollutant source summary for *E. coli***

| Assessment Unit | Pollutant Sources | Magnitude[(a)] (lbs/day) | Probable Sources[(b)] (% from each) |
|---|---|---|---|
| **Canadian River** (Ute Reservoir to Conchas Reservoir) | Point: | n/a | 0% |
| | Nonpoint: | $2.08 \times 10^{10}$ | 100% Drought-related impacts, rangeland grazing, wildlife other than waterfowl, avian sources (waterfowl and/or other), flow alterations from water diversions |
| **Canadian River** (Conchas River to Mora River) | Point: | n/a | 0% |
| | Nonpoint: | $3.94 \times 10^{11}$ | 100% Drought-related impacts, rangeland grazing, wildlife other than waterfowl, avian sources (waterfowl and/or other) |
| **Pajarito Creek** (Canadian River to headwaters) | Point: NM0020711 | $4.39 \times 10^{9}$ | 14% Municipal point source discharge |
| | Nonpoint: | $2.68 \times 10^{10}$ | 86% Avian sources (waterfowl and/or other), wildlife other than waterfowl, drought-related impacts, livestock (grazing or feeding operations), rangeland grazing |

**Notes**:
*(a)* Measured Load (Table 4.6). *Point source* magnitude is based on the WLA calculation from NPDES permit (Table 4.7).
*(b)* From the Integrated CWA 303(d)/305(b) List (NMED/SWQB 2010a). This list of probable sources is based on staff observation and known land use activities in the watershed. These sources are not confirmed nor quantified at this time.

The Probable Source Identification Sheets in Appendix A provide an approach for a visual analysis of potential pollutant sources along an impaired reach. Although this procedure is subjective, SWQB feels that it provides the best available information for the identification of probable sources of impairment in a watershed. The list of "Probable Sources" is not intended to single out any particular land owner or single land management activity and has therefore been labeled "Probable" and generally includes several sources for each impairment. Table 4.10 displays probable sources of impairment along the reach as determined by field reconnaissance and assessment. Probable sources of *E.coli* will be evaluated, refined, and changed as necessary through the Watershed-Based Plan (WBP).

## 4.6 Linkage of Water Quality and Pollutant Sources

Among the probable sources of bacteria are municipal point source discharges such as wastewater treatment facilities, poorly maintained or improperly installed (or missing) septic tanks, livestock grazing of valley pastures and riparian areas, upland livestock grazing, in addition to wastes from pets, waterfowl, and other wildlife. Howell et al. (1996) found that bacteria concentrations in underlying sediment increase when cattle (*Bos taurus*) have direct access to streams, such as the waters in the Canadian River watershed. Natural sources of bacteria are also present in the form of other wildlife such as elk, deer, and any other warm-blooded mammals. In addition to direct input from grazing operations and wildlife, *E. coli* concentrations may be subject to elevated levels as a result of resuspension of bacteria laden sediment during storm events. Temperature can also play a role in bacteria concentrations. Howell et al. (1996) observed that bacteria growth increases as water temperature increases, which may be a contributing factor in this watershed as well.

The bacteria loading in the Canadian River watershed probably originates from a combination of drought-related impacts, municipal point source discharges, and livestock and wildlife wastes. Habitat modifications such as loss of riparian habitat, road maintenance and runoff, and land development or redevelopment as well as other recreational pollution sources may also be important contributors of bacteria.

In order to determine exact sources and relative contributions, further study is needed. One method of characterizing sources of bacteria is a Bacterial, or Microbial, Source Tracking (BST) study. The extensive data collection, analyses, and funding necessary to determine bacterial sources were beyond the resources available for this study.

## 4.7 Margin of Safety

TMDLs should reflect a MOS based on the uncertainty or variability in the data, the point and nonpoint source load estimates, and the modeling analysis. The MOS can be expressed either implicitly or explicitly. An implicit MOS is incorporated by making conservative assumptions in the TMDL analysis, such as allocating a conservative load to background sources. An explicit MOS is applied by reserving a portion of the TMDL and not allocating it to any other sources.

For these bacteria TMDLs, the MOS was developed using a combination of conservative assumptions and explicit recognition of potential errors in flow calculations. Therefore, the MOS is the sum of the two elements:

- *Conservative Assumptions*

  *E.coli* bacteria does not readily degrade in the environment.

  Using the monthly geometric mean criterion rather than the single sample criterion, which allows for higher concentrations in individual grab samples, to calculate target loading values.

  Using the design capacity for calculating the point source loading even though under most conditions the treatment plants do not discharge continuously and are not operating at full capacity.

  Using the 4Q3 critical low flow “worst case scenario” to calculate the allowable loads.

- *Explicit recognition of potential errors*

  A level of uncertainty exists in sampling nonpoint sources of pollution. Accordingly, an explicit MOS of **10 percent** of the nonpoint source Load Allocation (LA) was assigned to this TMDL.

  Techniques used for measuring flow in water have a ± 5 percent precision. Accordingly, an explicit MOS of **5 percent** of the nonpoint source LA was assigned to this TMDL.

**Therefore, based on the potential errors described above an explicit MOS of 15% of the LA was assigned to these TMDLs.**

## 4.8 Consideration of Seasonal Variation

Federal regulations (40 CFR §130.7(c)(1)) require that TMDLs take into consideration seasonal variation in watershed conditions and pollutant loading. Data used in the calculation of these TMDLs were collected during the spring, summer, and fall of 2006 in order to ensure coverage of any potential seasonal variation in the system. Bacteria exceedences occurred during both high and low flow events. Higher flows may flush more nonpoint source runoff containing bacteria. It is possible the criterion may be exceeded under a low flow condition when there is insufficient dilution. Evaluation of seasonal variability for potential nonpoint sources is difficult due to limited available data.

## 4.9 Future Growth

Growth estimates by county are available from the New Mexico Bureau of Business and Economic Research. These estimates project growth to the year 2035. Growth estimates for Colfax County, San Miguel County, and Quay County project a 11%, 12%, and less than 1% growth rate through 2035, respectively.

According to the data, bacteria loading is primarily due to diffuse nonpoint sources. Estimates of future growth are not anticipated to lead to a significant increase in bacteria concentrations that cannot be controlled with best management practices (BMPs) in this watershed. However, it is imperative that BMPs continue to be utilized in this watershed to improve road conditions and grazing allotments and adhere to SWPPP requirements related to construction and industrial activities covered under the general permit.

# 5.0 PLANT NUTRIENTS

The potential for excessive nutrients in the mainstem of the Canadian River, Chicorica Creek, Pajarito Creek, and Uña de Gato Creek was noted through visual observation during the 2006 SWQB watershed survey. Detailed assessment of various water quality parameters indicated nutrient impairment in the Canadian River (Cimarron River to Colorado border), Pajarito Creek (Canadian River to headwaters), Uña de Gato Creek (Chicorica Creek to Highway 64), and Uña de Gato Creek (Highway 64 to headwaters).

## 5.1 Target Loading Capacity

For this TMDL document the target value for plant nutrients is based on numeric translators for the narrative criterion set forth in Subsection E of 20.6.4.13 NMAC:

> ***Plant Nutrients:*** *Plant nutrients from other than natural causes shall not be present in concentrations which will produce undesirable aquatic life or result in the dominance of nuisance species in surface waters of the state.*

This narrative criterion can be challenging to assess because the relationships between nutrient levels and impairment of designated uses are not defined, and distinguishing nutrients from "other than natural causes" is difficult. Therefore, SWQB (with the assistance from EPA and the USGS), developed a *Nutrient Assessment Protocol* (NMED/SWQB 2011b) to assist in meeting these challenges. The protocol was developed for wadeable streams because they represent the majority of assessed surface waters in the state. It addresses both cause (total nitrogen and total phosphorus) and response variables (dissolved oxygen (DO), pH, and periphyton chlorophyll *a*) and uses a weight-of-evidence approach. Threshold values for each of the cause and response variables are used to translate the narrative nutrient criterion into quantifiable endpoints (Table 5.1).

Water quality assessments for nutrients are based on quantitative measurements of select indicators. If these measurements exceed the numeric nutrient threshold values, indicate excessive primary production (i.e., large DO and pH fluctuation and/or high chlorophyll *a* concentration), and/or demonstrate an unhealthy biological community, the reach is considered to be impaired.

There are two potential causes of nutrient enrichment in a given stream: excessive nitrogen and/or phosphorus. The intent of criteria, or targets, for phosphorus and nitrogen is to control the excessive growth of attached algae and higher aquatic plants that can result from the introduction of these plant nutrients into streams. The reason for controlling plant growth is to preserve aesthetic and ecologic characteristics along the waterway. Numeric thresholds are necessary to establish targets for TMDLs, to develop water quality-based permit limits and source control plans, and to support designated uses within the watershed.

Phosphorous is found in water primarily as ortho-phosphate. In contrast nitrogen may be found as several dissolved species all of which must be considered in loading. Total Nitrogen is defined as the sum of Nitrate+Nitrite (N+N), and Total Kjeldahl Nitrogen (TKN). At the present time, there is no EPA-approved method to test for Total Nitrogen, however a combination of EPA method 351.2 (TKN) and EPA method 353.2 (Nitrate + Nitrite) is appropriate for estimating Total Nitrogen. The applicable threshold values for cause (phosphorus and nitrogen) and response (DO, pH, and chlorophyll *a*) variables are shown in Table 5.1. These threshold values are used for water quality assessments and TMDL development.

**Table 5.1. Applicable nutrient-related thresholds for Canadian River watershed**

| **Ecoregion →** | 21-Southern Rockies | 26-Southwestern Tablelands |
|---|---|---|
| **Aquatic Life Use →** | Warmwater | Warmwater |
| Total Phosphorus | 0.02 mg/L | 0.03 mg/L |
| Total Nitrogen | 0.25 mg/L | 0.45 mg/L |
| Dissolved Oxygen | 5.0 mg/L | 5.0 mg/L |
| pH | 6.6 – 9.0 | 6.6 – 9.0 |
| Chlorophyll *a* | 3.9 – 5.5 μg/cm$^2$ | 8.2 – 14 μg/cm$^2$ |

Pajarito Creek (Canadian River to headwaters) is located in Ecoregion 26 (Southwestern Tablelands with a designated use of marginal warmwater aquatic life (20.6.4 NMAC). According to Table 5.1, Pajarito Creek has in-stream nutrient target concentrations of 0.03 mg/L for total phosphorus and 0.45 mg/L for total nitrogen (Table 5.2).

Canadian River (Cimarron River to Colorado border), Uña de Gato Creek (Chicorica Creek to Highway 64), and Uña de Gato Creek (Highway 64 to headwaters) are located in Ecoregion 21 (Southern Rockies) and Ecoregion 26 (Southwestern Tablelands); however the majority of these assessment units fall within Ecoregion 26 with a designated use of marginal warmwater aquatic life. According to Table 5.1, these waters have in-stream nutrient target concentrations of 0.03 mg/L for total phosphorus and 0.45 mg/L for total nitrogen (Table 5.2).

Table 5.2. In-stream nutrient target concentrations

| Assessment Unit | Total Phosphorus | Total Nitrogen |
|---|---|---|
| Canadian River (Cimarron River to Colorado border) | 0.03 mg/L | 0.45 mg/L |
| Pajarito Creek (Canadian River to headwaters) | 0.03 mg/L | 0.45 mg/L |
| Uña de Gato Creek (Chicorica Creek to Highway 64) | 0.03 mg/L | 0.45 mg/L |
| Uña de Gato Creek (Highway 64 to headwaters) | 0.03 mg/L | 0.45 mg/L |

## 5.2 Flow

The presence of plant nutrients in a stream can vary as a function of flow. Higher nutrient concentrations typically occur during low-flow conditions because there is reduced stream capacity to assimilate nutrient inputs due to less streamflow available for dilution. In other words, as flow decreases, the stream cannot effectively dilute its constituents causing the concentration of plant nutrients to increase. Thus, a TMDL is calculated for each assessment unit at a specific flow.

The critical flow condition for these TMDLs occurs when the ratio of nutrient concentrations to stream flow is the greatest and was obtained using a 4Q3 regression model. The 4Q3 is the minimum average four consecutive day flow that occurs with a frequency of at least once every 3 years. Low flow was chosen as the critical flow because of the adverse effect low flows have on water quality due to increased nutrient concentrations and algal growth.

Table 5.3 Active USGS gages in the Canadian River watershed

| Agency | Site Number | Site Name | Period of Record |
|---|---|---|---|
| USGS | 07211500 | Canadian River near Taylor Springs, NM | 1964 – 2010 |

When available, USGS gages are used to estimate flow. There is one active gage in the Canadian Watershed that is appropriate to estimate flow for the impaired reaches (Table 5.3). The 4Q3 flow for the Canadian River (Cimarron River to Colorado border) was estimated using gage data from the Canadian River near Taylor Springs, NM and DFLOW software, Version 3.1b (USEPA 2006a). DFLOW 3.1b is a Windows-based tool developed to estimate user selected design stream flows for low flow analysis by utilizing algorithms based on Log Pearson Type III distribution.

A climatic year starting April 1 of the prior year and ending March 31 is often used when examining critical low flow conditions in the United States. This choice reduces the likelihood of splitting low flow periods - typically found in the summer or fall - across different years and thereby affecting the results of Log Pearson Type III analysis of series of annual low flows. A different climatic year or shorter season may be used if low flow periods occur at other times of the year or overlap the boundaries of the climatic year.

The calculated 4Q3 using DFLOW software is:

- Canadian River (Cimarron River to Colorado border) = 0.04 cfs

However, the critical flow for the Canadian River (Cimarron River to Colorado border) will be based on analysis methods described by Waltemeyer (2002) because the 4Q3 using DFLOW software is near zero. In addition, 4Q3 derivations for ungaged streams in the Canadian Watershed will also be based on analysis methods described by Waltemeyer (2002). In Waltemeyer's analysis, two regression equations for estimating 4Q3 were developed based on physiographic regions of NM (i.e., statewide and mountainous regions above 7,500 feet in elevation). The following statewide regression equation is based on data from 50 gaging stations with non-zero discharge:

$$4Q3 \quad = \quad 1.2856 \times 10^{-4} \ DA^{0.42} \ P_w^{\ 3.16} \qquad \text{(Eq. 5-1)}$$

where,

4Q3 = Four-day, three-year low-flow frequency (cfs)
DA = Drainage area ($mi^2$)
$P_w$ = Average basin mean winter precipitation (inches)

The average standard error of estimate (SEE) and coefficient of determination are 126 and 48 percent, respectively, for this regression equation (Waltemeyer 2002). The 4Q3s for the Canadian River, Pajarito Creek, and Uña de Gato Creek were estimated using the statewide regression equation (Eq. 5-1) because the mean elevations for these assessment units are below 7,500 feet in elevation (Table 5.4).

**Table 5.4 Calculation of 4Q3 low-flow frequencies**

| Assessment Unit | Average Elevation (ft.) | Drainage Area ($mi^2$) | Mean Winter Precipitation (in.) | 4Q3 (cfs) |
|---|---|---|---|---|
| **Canadian River** (Cimarron River to Colorado border) | 7008 | 1710 | 5.67 | 0.71 |
| **Pajarito Creek** (Canadian River to headwaters) | 4534 | 538 | 4.49 | 0.21 |
| **Uña de Gato Creek** (Chicorica Creek to Highway 64) | 7057 | 126 | 6.07 | 0.29 |
| **Uña de Gato Creek** (Highway 64 to headwaters) | 7182 | 96.9 | 6.32 | 0.30 |

The 4Q3 value for Pajarito Creek was converted from cubic feet per second (cfs) to units of million gallons per day (mgd) as follows:

$$0.21\,\frac{ft^3}{\sec}\times 1{,}728\,\frac{in^3}{ft^3}\times 0.004329\,\frac{gal}{in^3}\times 86{,}400\,\frac{\sec}{day}\times 10^{-6} = 0.13mgd$$

The 4Q3 values for the other waterbodies were calculated in a similar manner.

It is important to remember that the TMDL itself is a value calculated at a defined critical condition, and is calculated as part of planning process designed to achieve water quality standards. Since flows vary throughout the year in these systems, the actual load at any given time will vary based on the changing flow. Management of the load to improve stream water quality should be a goal to be attained.

## 5.3 Calculations

This section describes the relationship between the numeric target and the allowable pollutant-level by determining the waterbody's total assimilative capacity, or loading capacity, for the pollutant. The loading capacity is the maximum amount of pollutant loading that a waterbody can receive while meeting its water quality objectives.

As a river flows downstream it has a specific carrying capacity for nutrients. This carrying capacity, or TMDL, is defined as the mass of pollutant that can be carried under critical low-flow conditions without violating the target concentration for that constituent. These TMDLs were developed based on simple dilution calculations using 4Q3 flow, the numeric target, and a conversion factor. The specific carrying capacity of a receiving water for a given pollutant, may be estimated using Eq. 5-2.

4Q3 (in mgd) x Numeric Target (in mg/L) x 8.34 = TMDL (pounds per day [lbs/day]) (Eq. 5-2)
The daily target loads for TP and TN are summarized in Table 5.5.

**Table 5.5 Daily target loads for TP & TN**

| Assessment Unit | Parameter | Critical Flow (mgd) | In-Stream Target (mg/L) | Conversion Factor | TMDL (lbs/day) |
|---|---|---|---|---|---|
| **Canadian River** | Total Phosphorus | 0.46 | 0.03 | 8.34 | 0.115 |
| (Cimarron River to CO border) | Total Nitrogen | 0.46 | 0.45 | 8.34 | 1.73 |
| **Pajarito Creek** | Total Phosphorus | 1.05(1) | 0.03 | 8.34 | 0.263 |
| (Canadian River to headwaters) | Total Nitrogen | 1.05(1) | 0.45 | 8.34 | 3.94 |
| **Uña de Gato Creek** | Total Phosphorus | 0.19 | 0.03 | 8.34 | 0.048 |
| (Chicorica Creek to Hwy 64) | Total Nitrogen | 0.19 | 0.45 | 8.34 | 0.713 |
| **Uña de Gato Creek** | Total Phosphorus | 0.19 | 0.03 | 8.34 | 0.048 |

| Assessment Unit | Parameter | Critical Flow (mgd) | In-Stream Target (mg/L) | Conversion Factor | TMDL (lbs/day) |
|---|---|---|---|---|---|
| (Hwy 64 to headwaters) | Total Nitrogen | 0.19 | 0.45 | 8.34 | 0.713 |

(1) Combined flow based on design flow of Tucumcari WWTP (0.92 mgd) and 4Q3 of stream (0.13 mgd). The design flow of the new WWTP is expected to be 1.20 mgd. When operational the load for TMDL can be increased by increased flow at the in-stream target concentration as allowed under the State's Water Quality Management Plan (NMED, 2011c – see Section IV.B.1)

The measured loads for TP and TN were similarly calculated. In order to achieve comparability between the target and measured loads, the same flow value was used for both calculations. The arithmetic mean of the collected data was substituted for the target in Equation 5-2. The same conversion factor of 8.34 was used. The results are presented in Table 5.6.

**Table 5.6 Measured loads for TP and TN**

| Assessment Unit | Parameter | Critical Flow (mgd) | Arithmetic Mean Conc.(1) (mg/L) | Conversion Factor | Measured Load (lbs/day) |
|---|---|---|---|---|---|
| **Canadian River** | Total Phosphorus | 0.46 | 0.081 | 8.34 | 0.311 |
| (Cimarron River to CO border) | Total Nitrogen | 0.46 | 0.728 | 8.34 | 2.79 |
| **Pajarito Creek** | Total Phosphorus | 0.13(2) | 0.051 | 8.34 | 0.055 |
| (Canadian River to headwaters) | Total Nitrogen | 0.13(2) | 0.693 | 8.34 | 0.751 |
| **Uña de Gato Creek** | Total Phosphorus | 0.19 | 0.041 | 8.34 | 0.065 |
| (Chicorica Creek to Hwy 64) | Total Nitrogen | 0.19 | 0.552 | 8.34 | 0.875 |
| **Uña de Gato Creek** | Total Phosphorus | 0.19 | 0.130 | 8.34 | 0.206 |
| (Hwy 64 to headwaters) | Total Nitrogen | 0.19 | 1.06 | 8.34 | 1.68 |

(1) Arithmetic mean of TP and TN concentrations from SWQB's 2006 water quality survey.
(2) Since water quality data were taken at a station upstream from the Tucumcari WWTP, the flow value for this calculation is the 4Q3 of stream (0.13 mgd). **The measured load is the magnitude of nonpoint sources**.

## 5.4 Waste Load Allocations and Load Allocations

### 5.4.1 Waste Load Allocation

There are no Municipal Separate Storm Sewer System (MS4) storm water permits in these AUs. However, excess nutrient loading may be a component of some storm water discharges covered under general NPDES permits, so the load from these dischargers should be addressed.

Storm water discharges from construction activities are transient because they occur mainly during the construction itself, and then only during storm events. Coverage under the National Pollutant Discharge Elimination System (NPDES) Construction General Permit (CGP) for construction sites greater than one acre requires preparation of a Storm Water Pollution Prevention Plan (SWPPP) that includes identification and control of all pollutants associated with the construction activities to minimize impacts to water quality. The current CGP also includes state-specific requirements to implement site-specific interim and permanent stabilization, managerial, and structural solids, erosion, and sediment control Best Management Practices (BMPs) and/or other controls. BMPs are designed to prevent to the maximum extent practicable an increase in sediment load to the water body or an increase in a sediment-related parameter, such as total suspended solids, turbidity, siltation, stream bottom deposits, etc. BMPs also include measures to reduce flow velocity during and after construction compared to pre-construction conditions to assure that waste load allocations (WLAs) or applicable water quality standards, including the antidegradation policy, are met. Compliance with a SWPPP that meets the requirements of the CGP is generally assumed to be consistent with this TMDL.

Storm water discharges from active industrial facilities are generally covered under the current NPDES Multi-Sector General Permit (MSGP). This permit also requires preparation of an SWPPP, which includes specific requirements to limit (or eliminate) pollutant loading associated with the industrial activities in order to minimize impacts to water quality. Compliance with a SWPPP that meets the requirements of the MSGP is generally assumed to be consistent with this TMDL.

It is not possible to calculate individual WLAs for facilities covered by these General Permits at this time using available tools. Loads that are in compliance with the General Permits are therefore currently included as part of the load allocation (LA).

There are no active point source dischargers on the upper Canadian River and Uña de Gato Creek AUs. However, there is an existing point source with an individual NPDES permit that discharges to Pajarito Creek. Each NPDES-permitted facility that discharges into an impaired reach has a WLA included in this TMDL (Table 5.7).

The City of Tucumcari wastewater treatment plant (WWTP) (NM0020711) is authorized to discharge into Pajarito Creek under the stipulations described in its NPDES permit. Currently, this WWTP is not designed to treat effluent for the removal of nitrogen and phosphorus. The facility will need to develop and implement treatment to remove nutrients and improve water quality. Recognizing the need for significant upgrades, the City contracted with an engineering firm to design an updated wastewater treatment plant to improve the water quality of the discharge. Some improvement in nitrogen removal is expected if the new facility is constructed as described; however the amount of nutrient removal and resultant effluent concentrations remain to be determined. It is the policy of the Water Quality Control Commission to allow schedules of compliance in NPDES permits when facility modifications are necessary to meet new water quality based requirements.

Nutrient removal is one of the most pressing challenges facing wastewater treatment facilities. Nutrients can be removed from wastewater via biological, chemical, or combined biological and chemical processes. There are limits of removal that can be achieved with different removal mechanisms. The limit of technology, based on annual averages, is generally considered to be 0.1 mg/L for total phosphorus (TP) and 3 mg/L for total nitrogen (TN) (Jeyanayagam 2005). More recent studies by USEPA show that the limit of technology for total phosphorus is less than 0.01 mg/L. According to USEPA (2007), chemical addition to wastewater with aluminum- or iron-based coagulants followed by tertiary filtration can reduce total phosphorus concentrations in the final effluent to very low levels. Land application of tertiary effluent through soil has been shown to meet a TP effluent concentration of 0.01 mg/L at all times (USEPA 2008). In addition, the cost of applying tertiary treatment for phosphorus removal is affordable, with monthly residential sewer rates charged to maintain and operate the entire treatment facility ranging from as low as $18 to as high as $46 (USEPA 2007).

TP concentrations in treated effluent typically range from 0.1 to 1.0 mg/L, whereas TN concentrations typically range from 3.0 to 10.0 mg/L, depending on the removal process and site-specific conditions. Some facilities may be able to achieve lower concentrations by using a combination of biological and chemical treatments, however biological treatment is highly temperature dependent therefore seasonal limits may need to be considered in some cases. The choice of technology to be used as well as the option and use of seasonal limits depend on the site-specific conditions, such as temperature, dissolved oxygen levels, and pH in combination with the economic feasibility.

NMED believes that a TMDL should be written to targets that are protective of the stream and scientifically defensible however there should also be recognition of the limits of technology for nutrient removal. Even though the limits of technology preclude the attainment of the target concentrations defined in this TMDL, treatment would significantly reduce the load of TP and TN that is introduced into the stream. After implementation of a nutrient removal system and given enough time to allow the aquatic to system to respond, NMED will reevaluate the condition of Pajarito Creek. At that time, if the waterbody is still impaired for plant nutrients and there is no substantial improvement observed in the water quality, the WWTP would be required to enhance the treatment of the effluent by adding more effective treatment or find other means of disposal (Figure 5.1; Table 5.7).

A phased strategy is an iterative process and will require future data collection and analysis to determine if the load reductions achieved using effluent limits that are based on alternative target concentrations actually lead to attainment of water quality standards. Please refer to "Clarification Regarding "Phased" Total Maximum Daily Loads," an August 2, 2006 memorandum from the USEPA, for more information on this topic (USEPA 2006b). The next scheduled monitoring date for the Canadian River watershed is 2015 at which time the new WWTP should be fully operational and improvements in land application and re-use should be put into practice (see Section 7.1 for more details). SWQB monitoring in 2015 will evaluate the impact of the Phase 1 actions and limits (Figure 5.1; Table 5.7) by re-examining water quality in this watershed, re-assessing designated use attainment, and re-evaluating target concentrations and waste load allocations.

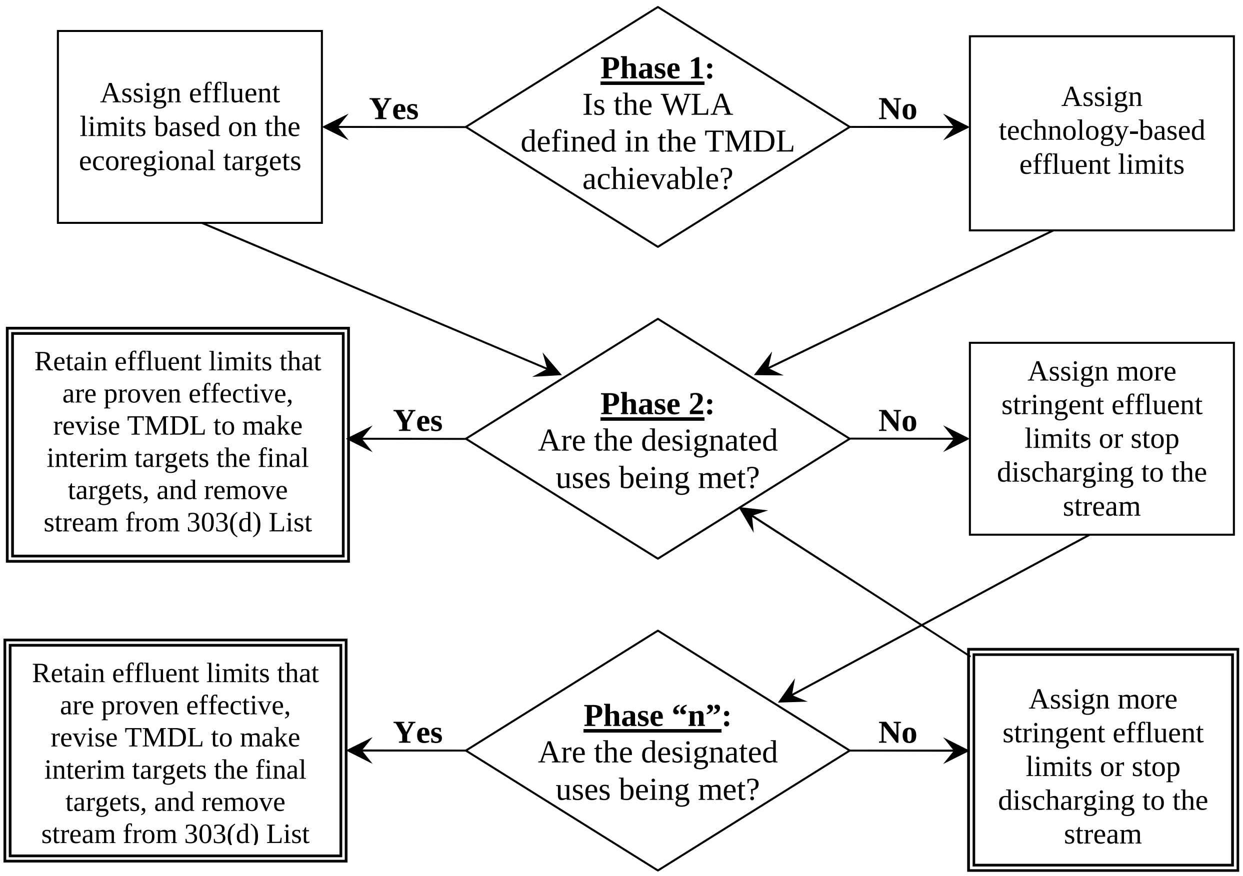



**Figure 5.1. Decision process for assigning effluent limits in a phased TMDL**

**Table 5.7 Nutrient Wasteload Allocations *over time* for Tucumcari WWTP (NM0020711)***

| Phase | Parameter | Design Capacity[a] (mgd) | Effluent Limit (mg/L) | Conversion Factor | Wasteload Allocation[e] (lbs/day) |
|---|---|---|---|---|---|
| 1st | Total Phosphorus | 0.92 | 1.0[b] | 8.34 | 7.67 |
| | Total Nitrogen | 0.92 | 8.0[b] | 8.34 | 61.4 |
| 2nd | Total Phosphorus | 0.92 | 0.1[c] | 8.34 | 0.77 |
| | Total Nitrogen | 0.92 | 3.0[c] | 8.34 | 23.0 |
| nth | Total Phosphorus | 0.92 | 0.03[d] | 8.34 | 0.23 |
| | Total Nitrogen | 0.92 | 0.45[d] | 8.34 | 3.45 |

* **Permit expires January 31, 2013.**

(a) Design capacity of the new WWTP is expected to be 1.2 mgd. When operational phased TMDL targets can be updated based on new design capacity in the current permit application.

(b) **Phase 1** effluent limits are technology based (i.e., achievable) annual averages that are designed to help communities begin the process of converting their WWTPs for nutrient removal. These limits are similar to the effluent limits adopted by the state of Virginia for existing facilities to implement their permitting program (http://www.deq.virginia.gov/bay/NOIRANutPermitLimits.pdf).

(c) **Phase 2** effluent limits are based on annual averages for the limits of technology. Biological treatment is highly temperature dependent therefore the permit may need to consider seasonal targets based on WWTP design.

(d) **Phase "n"** effluent limits based on in-stream nutrient target concentrations from Table 5.2. As of 2011, these values are technologically unachievable.

(e) WLA = (design capacity) x (effluent limit) x (conversion factor).

### 5.4.2 Load Allocation

In order to calculate the load allocation (LA) for phosphorus and nitrogen, the WLA and margin of safety (MOS) were subtracted from the target load (TMDL) using the following equation:

$$WLA + LA + MOS = TMDL, \text{ or}$$
$$LA = TMDL - WLA - MOS \qquad \text{(Eq. 5-3)}$$

The MOS was developed using a combination of conservative assumptions and explicit recognition of potential errors. Results using an explicit MOS of 15% (see Section 5.7 for details) are presented in Table 5.8.

**Table 5.8 Calculation of TMDLs for TP and TN**

| Assessment Unit | Parameter | WLA (lbs/day) | LA (lbs/day) | MOS* (15%) | TMDL (lbs/day) |
|---|---|---|---|---|---|
| **Canadian River** (Cimarron River to CO border) | Total Phosphorus | 0 | 0.098 | 0.017 | 0.115 |
| | Total Nitrogen | 0 | 1.47 | 0.260 | 1.73 |
| **Pajarito Creek** (Canadian River to headwaters) | Total Phosphorus | 0.23 | 0.028 | 0.005 | 0.263 |
| | Total Nitrogen | 3.45 | 0.416 | 0.074 | 3.94 |
| **Uña de Gato Creek** (Chicorica Creek to Hwy 64) | Total Phosphorus | 0 | 0.041 | 0.007 | 0.048 |
| | Total Nitrogen | 0 | 0.606 | 0.107 | 0.713 |
| **Uña de Gato Creek** (Hwy 64 to headwaters) | Total Phosphorus | 0 | 0.041 | 0.007 | 0.048 |
| | Total Nitrogen | 0 | 0.606 | 0.107 | 0.713 |

* The MOS was calculated as 15% of the nonpoint source Load Allocation, or MOS = 0.15 × (TMDL – WLA).

The load reductions that would be necessary to meet the target loads were calculated to be the difference between the calculated annual target load (Table 5.5) and the measured load (Table 5.6), and are shown in Table 5.9.

**Table 5.9 Calculation of load reduction for TP and TN**

| Assessment Unit | Parameter | Target Load[(a)] (lbs/day) | Measured Load (lbs/day) | Load Reduction (lbs/day) | Percent Reduction[(b)] |
|---|---|---|---|---|---|
| **Canadian River** (Cimarron River to CO border) | Total Phosphorus | 0.098 | 0.311 | 0.213 | 68% |
| | Total Nitrogen | 1.47 | 2.79 | 1.32 | 47% |
| **Pajarito Creek** (Canadian River to headwaters) | Total Phosphorus | 0.258 | 26.6[(c)] | 26.3 | 99% |
| | Total Nitrogen | 3.87 | 79.6[(c)] | 75.7 | 95% |
| **Uña de Gato Creek** (Chicorica Creek to Hwy 64) | Total Phosphorus | 0.041 | 0.065 | 0.024 | 37% |
| | Total Nitrogen | 0.606 | 0.875 | 0.269 | 31% |
| **Uña de Gato Creek** (Hwy 64 to headwaters) | Total Phosphorus | 0.041 | 0.206 | 0.165 | 80% |
| | Total Nitrogen | 0.606 | 1.68 | 1.07 | 64% |

Note: The MOS is not included in the load reduction calculations because it is a set aside value which accounts for any uncertainty or variability in TMDL calculations and therefore should not be subtracted from the measured load.
(a) Target Load = TMDL – MOS (refer to Table 5.5).
(b) Percent reduction is the percent the existing measured load must be reduced to achieve the target load, and is calculated as follows: (Measured Load – Target Load) / Measured Load x 100.
(c) The measured load is the magnitude of point *and* nonpoint sources provided in Table 5.10 and Table 5.11.

## 5.5 Identification and Description of Pollutant Sources

SWQB fieldwork includes an assessment of the probable sources of impairment (Appendix A). The approach for identifying "Probable Sources of Impairment" was recently modified by SWQB to include additional input from a variety of stakeholders including landowners, watershed groups, and local, state, tribal and federal agencies. Probable Source Sheets are filled out by SWQB staff during watershed surveys and watershed restoration activities. The draft probable source list will be reviewed and modified, as necessary, with watershed group/ stakeholder input during the TMDL public meeting and comment period.

**Table 5.10 Pollutant source summary for Total Phosphorus**

| Assessment Unit | Pollutant Sources | Magnitude (lbs/day) | Probable Sources[1] (% from each) |
|---|---|---|---|
| **Canadian River** (Cimarron River to CO border) | Point: | n/a | 0% |
| | Nonpoint: | 0.311 | 100% Animal feeding operations (NPS), flow alterations from water diversions, rangeland grazing |
| **Pajarito Creek** (Canadian River to headwaters) | Point: NM0020711 | 26.5[2] | 99% Municipal Point Source Discharge |
| | Nonpoint: | 0.055[2] | <1% Avian sources (waterfowl and/or other), wildlife (other than waterfowl), drought-related impacts, livestock (grazing or feeding operations), rangeland grazing |
| **Uña de Gato Creek** (Chicorica Creek to Hwy 64) | Point: | n/a | 0% |
| | Nonpoint: | 0.065 | 100% Drought-related impacts, rangeland grazing, wildlife (other than waterfowl) |
| **Uña de Gato Creek** (Hwy 64 to headwaters) | Point: | n/a | 0% |
| | Nonpoint: | 0.206 | 100% Drought-related impacts, rangeland grazing, wildlife (other than waterfowl) |

(1) From the Integrated CWA §303(d)/§305(b) List (NMED/SWQB 2010a). This list of probable sources is based on staff observation and known land use activities in the watershed. These sources are not confirmed nor quantified at this time.

(2) The **magnitude for Tucumcari WWTP** was calculated by multiplying the average effluent TP concentration measured in 2006 (5.4 mg/L), the average monthly discharge from 2008-2010 (0.589 mgd), and the 8.34 conversion factor to get the results in lbs/day. The **magnitude for nonpoint sources** is the measured load from Table 5.6.

**Table 5.11 Pollutant source summary for Total Nitrogen**

| Assessment Unit | Pollutant Sources | Magnitude (lbs/day) | Probable Sources[1] (% from each) |
|---|---|---|---|
| **Canadian River** (Cimarron River to CO border) | Point:<br>Nonpoint: | n/a<br>2.79 | 0%<br>100%<br>Animal feeding operations (NPS), flow alterations from water diversions, rangeland grazing |
| **Pajarito Creek** (Canadian River to headwaters) | Point: NM0020711<br>Nonpoint: | 78.8[2]<br>0.751[2] | 99%<br>Municipal Point Source Discharge<br>1%<br>Avian sources (waterfowl and/or other), wildlife (other than waterfowl), drought-related impacts, livestock (grazing or feeding operations), rangeland grazing |
| **Uña de Gato Creek** (Chicorica Creek to Hwy 64) | Point:<br>Nonpoint: | n/a<br>0.875 | 0%<br>100%<br>Drought-related impacts, rangeland grazing, wildlife (other than waterfowl) |
| **Uña de Gato Creek** (Hwy 64 to headwaters) | Point:<br>Nonpoint: | n/a<br>1.68 | 0%<br>100%<br>Drought-related impacts, rangeland grazing, wildlife (other than waterfowl) |

(1) From the Integrated CWA §303(d)/§305(b) List (NMED/SWQB 2010a). This list of probable sources is based on staff observation and known land use activities in the watershed. These sources are not confirmed nor quantified at this time.

(2) The **magnitude for Tucumcari WWTP** was calculated by multiplying the average effluent TN concentration measured in 2006 (16 mg/L), the average monthly discharge from 2008-2010 (0.589 mgd), and the 8.34 conversion factor to get the results in lbs/day. The **magnitude for nonpoint sources** is the measured load from Table 5.6.

The Probable Source Identification Sheets in Appendix A provide an approach for a visual analysis of a pollutant source along an impaired reach. Although this procedure is qualitative, SWQB feels that it provides the best available information for the identification of probable sources of impairment in a watershed. The list of "Probable Sources" is not intended to single out any particular land owner or single land management activity and has therefore been labeled "Probable" and generally includes several sources for each impairment. Table 5.10 and Table 5.11 display probable sources of impairment along each reach as determined by field reconnaissance and assessment. Probable sources of nutrients will be evaluated, refined, and changed as necessary through the Watershed-Based Plan (WBP).

## 5.6 Linkage between Water Quality and Pollutant Sources

The source assessment phase of TMDL development identifies sources of nutrients that may contribute to both elevated nutrient concentrations and the stimulation of algal growth in a waterbody. Where data gaps exist or the level of uncertainty in the characterization of sources is large, the recommended approach to TMDL assignments requires the development of allocations based on estimates utilizing the best available information.

Phosphorus and nitrogen generally drive the productivity of algae and macrophytes in aquatic ecosystems, therefore they are regarded as the primary limiting nutrients in freshwaters. The main reservoirs of natural phosphorus are rocks and natural phosphate deposits. Weathering, leaching, and erosion are all processes that breakdown rock and mineral deposits allowing phosphorus to be transported to aquatic systems via water or wind. The breakdown of mineral phosphorus produces inorganic phosphate ions ($H_2PO_4^-$, $HPO_4^{2-}$, and $PO_4^{3-}$) that can be absorbed by plants from soil or water (USEPA 1999). Phosphorus primarily moves through the food web as organic phosphorus (after it has been incorporated into plant or algal tissue) where it may be released as phosphate in urine or other waste by heterotrophic consumers and reabsorbed by plants or algae to start another cycle (Nebel and Wright 2000).

The largest reservoir of nitrogen is the atmosphere. About 80 percent of the atmosphere by volume consists of nitrogen gas ($N_2$). Although nitrogen is plentiful in the environment, it is not readily available for biological uptake. Nitrogen gas must be converted to other forms, such as ammonia ($NH_3$ and $NH_4^+$), nitrate ($NO_3^-$), or nitrite ($NO_2^-$) before plants and animals can use it. Conversion of gaseous nitrogen into usable mineral forms occurs through three biologically mediated processes of the nitrogen cycle: nitrogen fixation, nitrification, and ammonification (USEPA 1999). Mineral forms of nitrogen can be taken up by plants and algae and incorporated into plant or algal tissue. Nitrogen follows the same pattern of food web incorporation as phosphorus and is released in waste primarily as ammonium compounds. The ammonium compounds are usually converted to nitrates by nitrifying bacteria, making it available again for uptake, starting the cycle anew (Nebel and Wright 2000).

Rain, overland runoff, groundwater, drainage networks, and industrial and residential waste effluents transport nutrients to receiving waterbodies. Once nutrients have been transported into a waterbody they can be taken up by algae, macrophytes, and microorganisms either in the water column or in the benthos; they can sorb to organic or inorganic particles in the water column and/or sediment; they can accumulate or be recycled in the sediment; or they can be transformed and released as a gas from the waterbody (Figure 5.2).

As noted above, phosphorus and nitrogen are essential for proper functioning of ecosystems. However, excess nutrients cause conditions unfavorable for the proper functioning of aquatic ecosystems. Nuisance levels of algae and other aquatic vegetation (macrophytes) can develop rapidly in response to nutrient enrichment when other factors (e.g., light, temperature, substrate, etc.) are not limiting (Figure 5.2). The relationship between nuisance algal growth and nutrient enrichment in stream systems has been well documented in the literature (Welch 1992; Van Nieuwenhuyse and Jones 1996; Dodds et al. 1997; Chetelat et al. 1999). Unfortunately, the magnitude of nutrient concentration that constitutes an "excess" is difficult to determine and varies by ecoregion.

As described in Section 5.2, the presence of plant nutrients in a stream can vary as a function of flow. As flow decreases through water diversions and/or drought-related stressors, the stream cannot effectively dilute its constituents, which causes the concentration of plant nutrients to increase. Nutrients generally reach a waterbody from land uses that are in close proximity to the stream because the hydrological pathways are shorter and have fewer obstacles than land uses located away from the riparian corridor. However, during the growing season (i.e. in agricultural return flow) and in storm water runoff, distant land uses can become hydrologically connected to the stream, thus transporting nutrients from the hillslopes to the stream during these time periods.

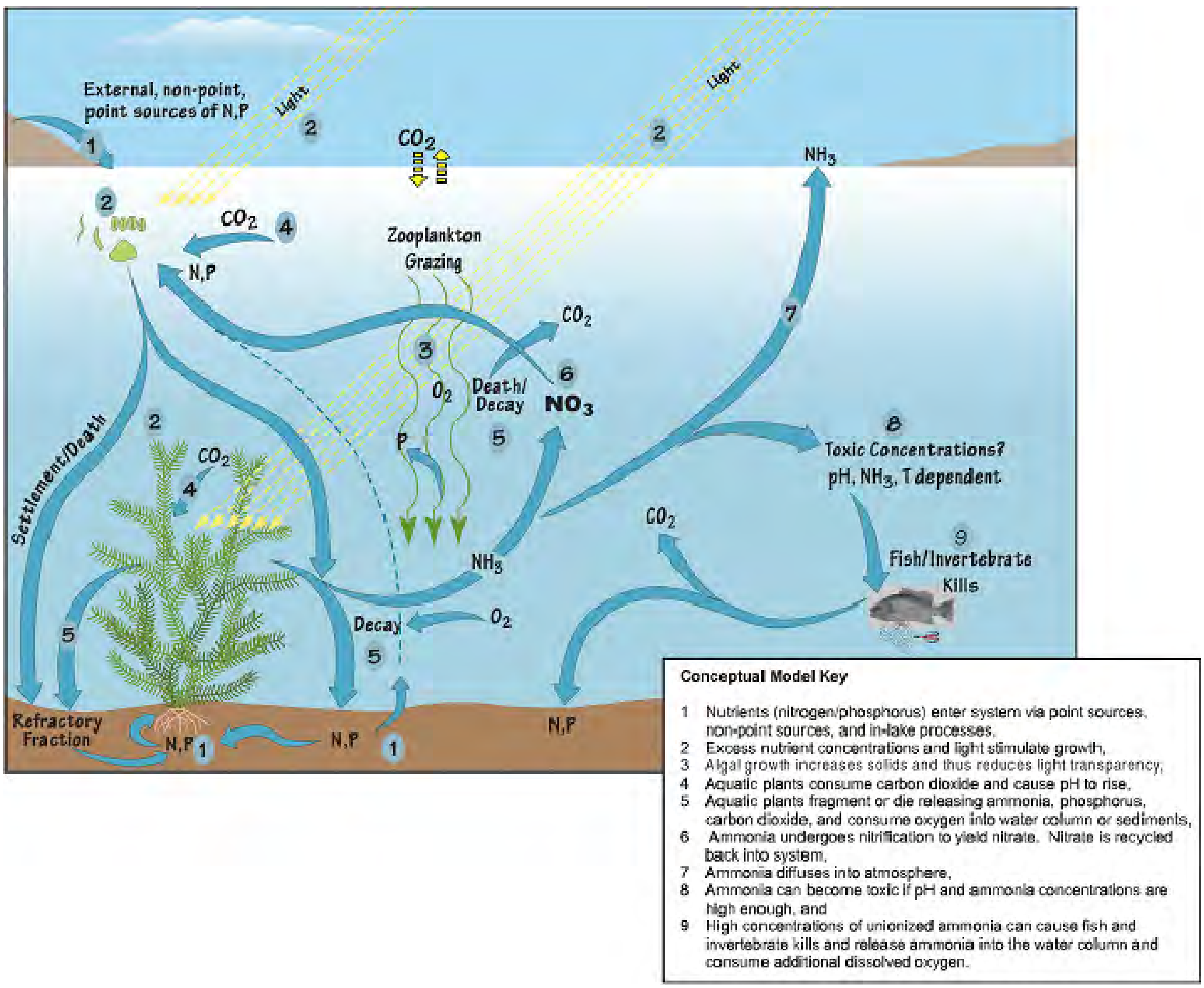



**Figure 5.2. Nutrient conceptual model (USEPA 1999)**

In addition to agriculture, there are several other human-related activities that influence nutrient concentrations in rivers and streams. Residential areas contribute nutrients from septic tanks, landscape maintenance, as well as backyard livestock (e.g. cattle, horses) and pet wastes. Urban development contributes nutrients by disturbing the land and consequently increasing soil erosion, by increasing the impervious area within the watershed, and by directly applying nutrients to the landscape. Recreational activities such as hiking and biking can also contribute nutrients to the stream by reducing plant cover and increasing soil erosion (e.g. trail network, streambank destabilization), direct application of human waste, campfires and/or wildfires, and dumping trash near the riparian corridor.

Undeveloped, or natural, landscapes also can deliver nutrients to a waterbody through decaying plant material, soil erosion, and wild animal waste. Another geographically occurring nutrient source is atmospheric deposition, which adds nutrients directly to the waterbody through dryfall and rainfall. Atmospheric phosphorus and nitrogen can be found in both organic and inorganic particles, such as pollen and dust. The contributions from these natural sources are generally considered to represent background levels.

Water pollution caused by on-site septic systems is a widespread problem in New Mexico (McQuillan 2004). Septic system effluents have contaminated more water supply wells, and more acre-feet of ground water, than all other sources in the state combined. Groundwater contaminated by septic system effluent can discharge into streams gaining from groundwater inflow. Nutrients such as phosphorous and nitrogen released into gaining streams from aquifers contaminated by septic systems can contribute to eutrophic conditions.

## 5.7 Margin of Safety (MOS)

TMDLs should reflect a MOS based on the uncertainty or variability in the data, the point and nonpoint source load estimates, and the modeling analysis. The MOS can be expressed either implicitly or explicitly. An implicit MOS is incorporated by making conservative assumptions in the TMDL analysis, such as allocating a conservative load to background sources. An explicit MOS is applied by reserving a portion of the TMDL and not allocating it to any other sources.

For these nutrient TMDLs, the margin of safety was developed using a combination of conservative assumptions and explicit recognition of potential errors. Therefore, this margin of safety is the sum of the following two elements:

- *Conservative Assumptions*

  Treating phosphorus and nitrogen as pollutants that do not readily degrade in the environment.

  Using the 4Q3 critical low flow "worst case scenario" to calculate the allowable loads.

  Using the design capacity for calculating the point source loading even though under most conditions the treatment plant does not discharge continuously and is not operating at full capacity.

- *Explicit recognition of potential errors*

  A level of uncertainty exists in sampling nonpoint sources of pollution. Accordingly, an explicit MOS of **10 percent** of the nonpoint source Load Allocation (LA) was assigned to this TMDL.

  Flow was based on the estimation of the 4Q3 for ungaged streams and compared to actual flows and cross-sectional information taken in the field. Techniques used for measuring flow in water have a ± 5 percent precision. Accordingly, an explicit MOS of **5 percent** of the nonpoint source LA was assigned to this TMDL.

**Therefore, based on the potential errors described above an explicit MOS of 15% of the LA was assigned to this TMDL.**

## 5.8 Consideration of Seasonal Variability

Section 303(d)(1) of the CWA requires TMDLs to be "established at a level necessary to implement the applicable WQS with seasonal variation." Data used in the calculation of this TMDL were collected during spring, summer, and fall in order to ensure coverage of any potential seasonal variation in the system. Exceedences were observed from March through October, during all seasons, which captured flow alterations related to snowmelt, the growing season, and summer monsoonal rains. The critical condition used for calculating the TMDL was low-flow. Calculations made at the critical low-flow (4Q3), in addition to using other conservative assumptions as described in the previous section on MOS, should be protective of the water quality standards designed to preserve aquatic life in the stream. It was assumed that if critical conditions were met during this time, coverage of any potential seasonal variation would also be met.

## 5.9 Future Growth

Growth estimates by county are available from the New Mexico Bureau of Business and Economic Research. These estimates project growth to the year 2035. Growth estimates for Colfax County, San Miguel County, and Quay County project an 11%, 12%, and less than 1% growth rate through 2035, respectively.

Nutrient loading in this watershed is due to both point and nonpoint sources. Since future projections indicate that nonpoint sources of nutrients will more than likely increase as the region continues to grow and develop, it is imperative that BMPs continue to be utilized in this watershed to improve road conditions and grazing allotments and adhere to SWPPP requirements related to construction and industrial activities covered under the general permit.

# 6.0 MONITORING PLAN

Pursuant to CWA Section 106(e)(1), the SWQB has established appropriate monitoring methods, systems and procedures in order to compile and analyze data on the quality of the surface waters of New Mexico. In accordance with the New Mexico Water Quality Act, the SWQB has developed and implemented a comprehensive water quality monitoring strategy for the surface waters of the State.

The monitoring strategy establishes the methods of identifying and prioritizing water quality data needs, specifies procedures for acquiring and managing water quality data, and describes how these data are used to progress toward three basic monitoring objectives: to develop water quality-based controls, to evaluate the effectiveness of such controls, and to conduct water quality assessments.

The SWQB utilizes a rotating basin system approach to water quality monitoring. In this system, a select number of watersheds are intensively monitored each year with an established return frequency of approximately every eight years. The next scheduled monitoring date for the Canadian River watershed is 2016 (NMED/SWQB 2010c). The SWQB maintains current quality assurance and quality control plans to cover all monitoring activities. This document, called the QAPP, is updated and certified annually by USEPA Region 6 (NMED/SWQB 2011). In addition, the SWQB identifies the data quality objectives required to provide information of sufficient quality to meet the established goals of the program. Current priorities for monitoring in the SWQB are driven by the CWA Section 303(d) list of streams requiring TMDLs. Short-term efforts were directed toward those waters that are on the USEPA TMDL consent decree list (U.S. District Court for the District of New Mexico 1997), however NMED/SWQB completed the final remaining TMDL on the consent decree in December 2006 and USEPA approved this TMDL in August 2007. The U.S. District Court dismissed the Consent Decree on April 21, 2009.

Once assessment monitoring is completed, those reaches showing impacts and requiring a TMDL will be targeted for more intensive monitoring. The methods of data acquisition include fixed-station monitoring, intensive surveys of priority assessment units (including biological assessments), and compliance monitoring of industrial, federal, and municipal dischargers, as specified in the SWQB Assessment Protocols (NMED/SWQB 2011).

Long-term monitoring for assessments will be accomplished through the establishment of sampling sites that are representative of the waterbody and which can be revisited approximately every eight years. This information will provide time relevant information for use in CWA Section 303(d) listing and 305(b) report assessments and to support the need for developing TMDLs. The approach provides:

- a systematic, detailed review of water quality data which allows for a more efficient use of valuable monitoring resources;
- information at a scale where implementation of corrective activities is feasible;

- an established order of rotation and predictable sampling in each basin which allows for enhanced coordinated efforts with other programs; and
- program efficiency and improvements in the basis for management decisions.

SWQB revised its 10-year monitoring and assessment strategy and submitted it to EPA Region 6 for review on March 23, 2010 (NMED/SWQB 2010c). The strategy details both the extent of monitoring that can be accomplished with existing resources plus expanded monitoring strategies that could be implemented given additional resources. According to the watershed rotation described in the strategy, the next time SWQB will conduct a water quality survey in the Canadian River watershed is 2016.

It should be noted that a watershed would not be ignored during the years in between water quality surveys. The rotating basin program will be supplemented with other data collection efforts such as the funding of long-term USGS water quality gaging stations for long-term trend data and on-going studies being performed by the USGS and USEPA. Data will be analyzed and field studies will be conducted to further characterize acknowledged problems and TMDLs will be developed and implemented accordingly. Both long-term and intensive field studies can contribute to the State's Integrated §303(d)/§305(b) listing process for waters requiring TMDLs.

# 7.0 IMPLEMENTATION OF TMDLS

## 7.1 Point Sources and NPDES Permitting

The City of Tucumcari Wastewater Treatment Plant (WWTP) discharges to Pajarito Creek under authorization of an NPDES permit, but the facility is currently not designed to treat effluent for total phosphorus and total nitrogen. The existing WWTP was built in 1982 and is a fixed media biological treatment system consisting of solids removal, primary and secondary clarification, a trickling filter followed by a series of Rotating Biological Chambers (RBCs), chlorine disinfection, and de-chlorination. Since the time the WWTP was built, the need for more extensive treatment has outgrown the effectiveness of the nearly 30 year old technology and design. The plant treatment works are also badly worn and in need of constant repair. In recent years, this treatment plant has been subject to several plant failures that resulted in the discharge of effluent exceeding NPDES permit limits and at times catastrophic failures that resulted in the release of up to 300,000 gallons of untreated sewage (2007). The City of Tucumcari received an Administrative Order CWA-06-2011-1764, from the USEPA on 5-10-2011 for Effluent Exceedences of the NPDES permit.

Recognizing the need for significant upgrades, the City contracted with an engineering firm to develop a Preliminary Engineering Review (PER) to design a wastewater treatment plant to update the facility and improve the water quality of the discharge. Construction is approximately 80% complete at this time and is expected to be completed in the fall of 2011. Some improvement in nitrogen removal is expected if the new facility is constructed as described. Representatives from the City claim the effluent quality that would be produced with the proposed facility is TN = 14.5 mg/L (approximately 10% less than the existing treatment). The upgrades are not designed for phosphorus removal and are not expected to remove any significant amounts of phosphorus above and beyond that required to support the biological processes. Tucumcari also has been awarded funds for a water conservation and reuse project that will construct a water reuse storage pond, pump station and pipeline to the New Mexico State University research facility.

Nutrient removal is one of the most pressing challenges facing wastewater treatment facilities today. Several technologies for nutrient removal exist. Phosphorus and nitrogen can be removed from wastewater via biological, chemical, or combined biological and chemical processes. There are theoretical limits for the lowest levels that can be achieved with different removal mechanisms. The choice of technology to be used depends on site-specific conditions and economic feasibility.

Funding of treatment facility modification or replacement needs some consideration in this TMDL. One potential source of funding to carry out a project that embraces the intent of the wasteload allocation (WLA) is the New Mexico Clean Water State Revolving Loan Fund program administered by NMED's Construction Program Bureau. The State of New Mexico *Statewide Water Quality Management Plan and Continuing Planning Process* Work Element VI (adopted by the WQCC May 10, 2011 and currently pending approval by the USEPA) notes that "…[a]s specified at 40 CFR 130.12(b), CWA Section 201 funding can only be awarded to DMAs [Designated Management Agencies] that are in conformance with the statewide WQMP." The City of Tucumcari is a Designated Management Agency (WQMP Work Element VI), thus the first part above requirement has been met. As this WLA is a part of the WQMP, funding will among other factors, be contingent on conformance with this part of the plan as well. The implementation of this WLA recognizes the technological and economic challenge of meeting the nutrient effluent limitations presented herein and as discussed below and therefore provides several implementation options for the WWTP; nonetheless the options presented below are not exclusive and other options may be explored.

Three options for implementing Phase 1 of the TMDL are discussed in detail below. Although the effluent limits in these options would not meet the targets of the TMDL as defined in Table 5.5, they would significantly reduce the loads of TP and TN that are introduced into Pajarito Creek. After implementation of Phase 1 and given enough time to allow the aquatic to system to respond, NMED would then reevaluate the condition of Pajarito Creek and the nutrient TMDL based on not meeting the causative factors (Total nitrogen and phosphorous concentration) and response variables (dissolved oxygen, pH and periphyton chlorophyll a concentration) as specified in Table 5.1. At the time that NMED reevaluates the conditions in Pajarito Creek, if it is found to still be impaired for plant nutrients, the City of Tucumcari WWTP would be required to increase the treatment of the effluent by incorporating additional treatment technologies or find another means of disposal (Figure 5.1; Table 7.1).

**Table 7.1. General Timeline of Events**

| Date | Activity |
|---|---|
| 2006 | SWQB Water Quality Survey |
| 2007 | Current NPDES permit issued to Tucumcari WWTP (NM0020711) |
| 2008 | Pajarito Creek (Canadian River to headwaters) listed as impaired due to nutrients |
| Summer 2011 | TMDL drafted; Implement Phase 1 |
| Fall 2011 | Construction completed on new WWTP; WWTP goes on-line |
| 2012 | WWTP optimization |
| 2013 | NPDES permit reissued (with Phase 1 limits/implementation) |
| 2015 | SWQB Water Quality Survey |
| 2018 | Evaluate and assess data to determine success of Phase 1 implementation |

**OPTION 1 – Year Round Limits**

The plant would be required to meet the Phase 1 limits as stated in Table 5.7 year round. This may require the City of Tucumcari to enhance the treatment over the currently planned WWTP (e.g. one that has both biological and chemical treatment processes).

- TP = 1.0 mg/L (30-day average)
- TN = 8.0 mg/L (30-day average)

**OPTION 2 – No Discharge (100% Re-Use)**

The WWTP would permanently discontinue discharge to Pajarito Creek and 100% of the WWTP effluent would be used for irrigation and other purposes pursuant to Tucumcari's ground water Discharge Permit (DP-1700) and other ground water Discharge Permits issued to separate users under the Ground and Surface Water Protection Regulations of the Water Quality Control

Commission (WQCC; 20.6.2 NMAC). The City would need to implement a cohesive strategy for storing and reusing all of its effluent, which would likely include the construction of substantial lined storage impoundments so that the effluent could be stored at times when irrigation was inappropriate (cold weather, precipitation events, etc.). Sufficient uses for the effluent would have to be developed with some safety margin included. The reuse practices would have to ensure that non-point source pollution from the reuse did not result in continued impairment of Pajarito Creek.

**OPTION 3 – Combination of Approaches (Seasonal Limits)**
Biological treatment is highly temperature dependent therefore the new NPDES permit may need to consider seasonal targets based on the facility's design. Below is an example of a possible seasonal component that could be incorporated into the new permit:

From October 1 through March 31 each year, when in-stream biological activity is generally at its lowest due to lower temperatures and shorter periods of daylight, the effluent limits would be based on the capabilities of the upgraded Tucumcari facility. Although these effluent limits are relatively high and substantially higher than the in-stream target concentrations in this TMDL, they would reduce the loading from the facility by roughly half during these months.

- TP = 3.0 mg/L (30-day average)
- TN = 10.0 mg/L (30-day average)

From April 1 through September 30 each year, when in-stream biological activity is generally at its highest due to higher temperatures and longer periods of daylight, the WWTP would not discharge to Pajarito Creek. During this period, 100% of the WWTP effluent would be used for irrigation and other purposes pursuant to Tucumcari's ground water Discharge Permit (DP-1700) and other ground water Discharge Permits issued to separate users under the WQCC Regulations. The construction of additional lined storage impoundments may be necessary (for times when irrigation is not appropriate) and the reuse practices would have to ensure that non-point source pollution from the reuse did not result in continued impairment of Pajarito Creek.

*As noted above, the City of Tucumcari WWTP discharges into Pajarito Creek under authorization of an NPDES permit. Federal regulations (40 CFR 130.12(a) and 40 CFR 122.44(d)(1)(vii)) clearly require that NPDES permits must be consistent with the WLA of an adopted and approved TMDL. This facility will need to develop and implement treatment to meet the new effluent requirements that will result from this TMDL; however it is the policy of the EPA to allow schedules of compliance in NPDES permits on a case-by-case basis where facility modifications need to be made to meet new water quality based requirements (20.6.4.12 NMAC).* ***It should be noted that these are only recommendations. EPA Region 6, in consultation with the City of Tucumcari and NMED staff, will determine which option to implement including the associated permit language and effluent limitations.***

## 7.2 Nonpoint Sources – WBP and BMP Coordination

Public awareness and involvement will be crucial to the successful implementation of these plans and improved water quality. Staff from SWQB will work with stakeholders to provide guidance in developing a Watershed-Based Plan (WBP). The WBP is a written plan intended to provide a long-range vision for various activities and management of resources in a watershed. It includes opportunities for private landowners and public agencies in reducing and preventing nonpoint source impacts to water quality. This long-range strategy will become instrumental in coordinating efforts to achieve water quality standards in the watershed. The WBP is essentially the Implementation Plan, or Phase Two of the TMDL process. The completion of the TMDLs and WBP leads directly to the development of on-the-ground projects to address surface water impairments in the watershed.

The Watershed Protection Section of the SWQB provides Clean Water Act (CWA) §319(h) funding to assist in implementation of BMPs to address water quality problems on reaches listed as category 4 or 5 waters on the Integrated §303(d)/ §305(b) list. These monies are available to all private, for profit and nonprofit organizations that are authenticated legal entities, or governmental jurisdictions including: cities, counties, tribal entities, Federal agencies, or agencies of the State. Proposals are submitted by applicants each year through a Request for Proposal (RFP) process and require a non-federal match of 40% of the total project cost consisting of funds and/or in-kind services. Funding is available for both watershed group formation (which includes WBP development) and on-the-ground projects to improve surface water quality and associated habitat. Further information on funding from the CWA §319 (h) can be found at the SWQB website: http://www.nmenv.state.nm.us/swqb/.

SWQB staff will assist with any technical assistance such as selection and application of BMPs needed to meet WBP goals. Stakeholder public outreach and involvement in the implementation of this TMDL will be ongoing. Stakeholders in this process will include SWQB and other members of the WBP.

## 8.0 APPLICABLE REGULATIONS and STAKEHOLDER ASSURANCES

New Mexico's Water Quality Act (Act) authorizes the WQCC to "promulgate and publish regulation to prevent or abate water pollution in the state" and to require permits. The Act authorizes a constituent agency to take enforcement action against any person who violates a water quality standard. Several statutory provisions on nuisance law could also be applied to NPS water pollution. The Water Quality Act also states in §74-6-12(a):

> *The Water Quality Act (this article) does not grant to the commission or to any other entity the power to take away or modify the property rights in water, nor is it the intention of the Water Quality Act to take away or modify such rights.*

In addition, the State of New Mexico Surface Water Quality Standards (see Subsection C of 20.6.4.6 NMAC) (NMAC 2011) states:

> *Pursuant to Subsection A of Section 74-6-12 NMSA 1978, this part does not grant to the water quality control commission or to any other entity the power to take away or modify property rights in water*.

New Mexico policies are in accordance with the federal Clean Water Act §101(g):

> *It is the policy of Congress that the authority of each State to allocate quantities of water within its jurisdiction shall not be superseded, abrogated or otherwise impaired by this Act. It is the further policy of Congress that nothing in this Act shall be construed to supersede or abrogate rights to quantities of water which have been established by any State. Federal agencies shall co-operate with State and local agencies to develop comprehensive solutions to prevent, reduce and eliminate pollution in concert with programs for managing water resources.*

New Mexico's CWA §319 Program has been developed in a coordinated manner with the State's 303(d) process. All 319 watersheds that are targeted in the annual RFP process coincide with the State's biennial impaired waters list as approved by USEPA. The State has given a high priority for funding, assessment, and restoration activities to these watersheds.

As a constituent agency, NMED has the authority under Chapter 74, Article 6-10 NMSA 1978 to issue a compliance order or commence civil action in district court for appropriate relief if NMED determines that actions of a "person" (as defined in the Act) have resulted in a violation of a water quality standard including a violation caused by a NPS. The NMED NPS water quality management program has historically strived for and will continue to promote voluntary compliance to NPS water pollution concerns by utilizing a voluntary, cooperative approach. The State provides technical support and grant monies for implementation of BMPs and other NPS prevention mechanisms through §319 of the Clean Water Act. Since portions of this TMDL will be implemented through NPS control mechanisms, the New Mexico Watershed Protection Program will target efforts to this and other watersheds with TMDLs.

In order to obtain reasonable assurances for implementation in watersheds with multiple landowners, including federal, state and private land, NMED has established Memoranda of Understanding (MOUs) with various federal agencies, in particular the Forest Service and the Bureau of Land Management. MOUs have also been developed with other state agencies, such as the New Mexico Department of Transportation. These MOUs provide for coordination and consistency in dealing with NPS issues.

The time required to attain standards for all reaches is estimated to be approximately 10-20 years. This estimate is based on a five-year time frame implementing several watershed projects that may not be starting immediately or may be in response to earlier projects. Stakeholders in this process will include SWQB, and other parties identified in the WBP. The cooperation of watershed stakeholders will be pivotal in the implementation of these TMDLs as well.

## 9.0 PUBLIC PARTICIPATION

Public participation was solicited in development of this TMDL (see **Appendix B**). The draft TMDL was made available for a 30-day comment period beginning on June 6, 2011. Response to comments were attached as **Appendix C** to the final draft of this document. The draft document notice of availability was extensively advertised via newsletters, email distribution lists, webpage postings (http://www.nmenv.state.nm.us), and press releases to area newspapers. A public meeting was held on June 15, 2011 from 6-8pm at Tucumcari Convention Center.

Once the TMDL was approved by the Water Quality Control Commission, the next step for public participation is a revision of the WBP as described in Section 8.0 and participation in watershed protection projects including those that may be funded by Clean Water Act Section 319(h) grants. The WBP development process is open to any member of the public who wants to participate.

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# APPENDIX A
# PROBABLE SOURCES OF IMPAIRMENT

“Sources” are defined as activities that may contribute pollutants or stressors to a water body (USEPA 1997). The list of “Probable Sources of Impairment” in the Integrated 303(d)/305(b) List, Total Maximum Daily Load documents (TMDL’s), and Watershed-Based Plans (WBP’s) is intended to include any and all activities that could be contributing to the identified cause of impairment. Data on Probable Sources is routinely gathered by Monitoring and Assessment Section staff and Watershed Protection Section staff during water quality surveys and watershed restoration projects and is housed in the Assessment Database (ADB version 2). ADB was developed by USEPA to help states manage information on surface water impairment and to generate §303(d)/ §305(b) reports and statistics. More specific information on Probable Sources of Impairment is provided in individual watershed planning documents (e.g., TMDL’s, WBP’s, etc) as they are prepared to address individual impairments by assessment unit.

USEPA through guidance documents strongly encourages states to include a list of Probable Sources for each listed impairment. According to the 1998 305(b) report guidance, “…, states must always provide aggregate source category totals…” in the biennial submittal that fulfills CWA section 305(b)(1)(C) through (E) (USEPA 1997). The list of “Probable Sources” is not intended to single out any particular land owner or single land management activity and has therefore been labeled “Probable” and generally includes several sources for each known impairment.

The approach for identifying “Probable Sources of Impairment” was recently modified by SWQB. Any new impairment listing will be assigned a Probable Source of “Source Unknown.” Probable Source Sheets will continue to be filled out during watershed surveys and watershed restoration activities by SWQB staff. Information gathered from the Probable Source Sheets will be used to generate a draft Probable Source list in consequent TMDL planning documents. These draft Probable Source lists will be finalized with watershed group/stakeholder input during the pre-survey public meeting, TMDL public meeting, WBP development, and various public comment periods. The final Probable Source list in the approved TMDL will be used to update the subsequent Integrated List.

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**Figure A1. Probable Source Development Process and Public Particpation Flowchart**

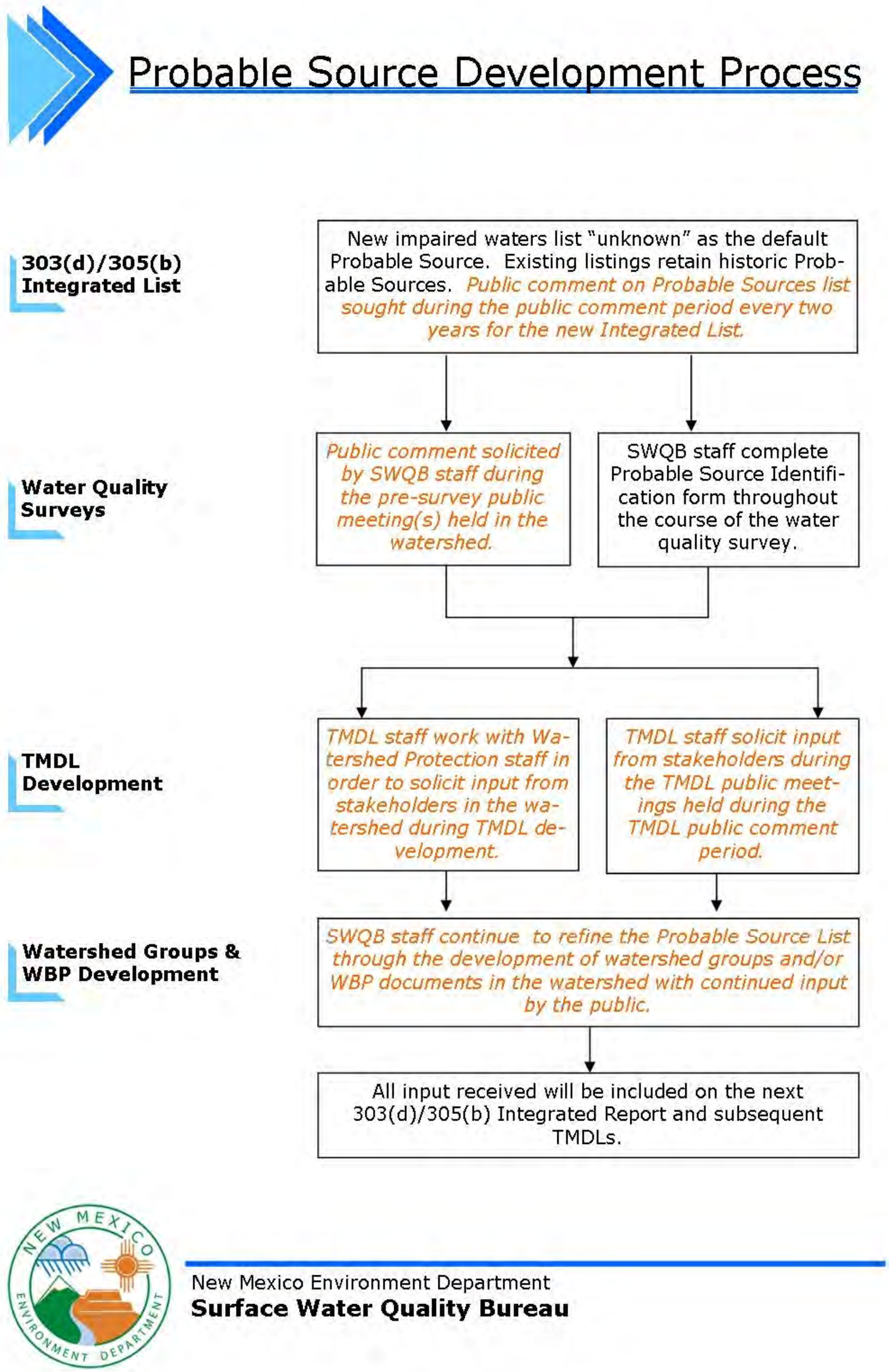

**Figure A2. Probable Source Identification Sheet for the Public**

## Help Us Identify Probable Sources of Impairment

| |
|---|
| **Name:** |
| Phone Number (optional): |
| Email or Mailing Address (optional): |
| **Date:** |
| **Waterbody Name/ Watershed Name/ Location of concern:** |

From the list below, please check the items you believe are sources of water quality impairment in the watershed or waterbody of concern. In the spaces next to each item you check, please use the following scale to indicate how much of a concern that item is to you by specifying a number between 1 and 3.

(1 - Slight Concern) (2 – Moderate Concern) (3 – High Concern)

| ✓ | ACTIVITY | Scale of Concern | | | ✓ | ACTIVITY | Scale of Concern | | |
|---|---|---|---|---|---|---|---|---|---|
| ☐ | Feedlots | 1 | 2 | 3 | ☐ | Pavement and Other Impervious Surfaces | 1 | 2 | 3 |
| ☐ | Livestock Grazing | 1 | 2 | 3 | ☐ | Roads/Bridges/Culverts | 1 | 2 | 3 |
| ☐ | Agriculture | 1 | 2 | 3 | ☐ | Habitat Modification(s) | 1 | 2 | 3 |
| ☐ | Flow Alterations (water withdrawal) | 1 | 2 | 3 | ☐ | Mining/Resource Extraction | 1 | 2 | 3 |
| ☐ | Stream/River Modification(s) | 1 | 2 | 3 | ☐ | Logging/Forestry Operations | 1 | 2 | 3 |
| ☐ | Storm Water Runoff | 1 | 2 | 3 | ☐ | Housing or Land Development | 1 | 2 | 3 |
| ☐ | Flooding | 1 | 2 | 3 | ☐ | Exotic species | 1 | 2 | 3 |
| ☐ | Landfill(s) | 1 | 2 | 3 | ☐ | Waterfowl | 1 | 2 | 3 |
| ☐ | Industry/Wastewater Treatment Plant | 1 | 2 | 3 | ☐ | Wildlife and domesticated animals other than waterfowl | 1 | 2 | 3 |
| ☐ | Inappropriate Waste Disposal | 1 | 2 | 3 | ☐ | Recreational Use | 1 | 2 | 3 |
| ☐ | Improperly maintained Septic Systems | 1 | 2 | 3 | ☐ | Natural Disturbances *(please describe)* | 1 | 2 | 3 |
| ☐ | Other: *(please describe)* | 1 | 2 | 3 | ☐ | Other: *(please describe)* | 1 | 2 | 3 |
| Comments: | | | | | | | | | |

## Figure A3. Probable Source Identification Sheet for NMED and Other Agencies

16 Mar 09
Ver. 2

### Probable Source Field Sheet & Site Condition Class Verification

| | | |
|---|---|---|
| Station ID: | Station Name/Description: | |
| Field Crew: | Comments: | |
| Date: | Watershed protection staff reviewer: | Date of WPS review: |
| WQS Segment from 20.6.4 NMAC: | Assessment Unit: | |

**Score the proximity and certainty of occurance of the following activities in the watershed upstream of the site. Consult with the appropriate staff at NMED and other agencies to score shaded cells. Fill out after recon during 1st or 2nd site visit, review and revise at the end of the survey, and have it reviewed by Watershed Protection Staff with knowledge of the particular watershed. Maintain completed forms in Survey Binder.**

### Activity Checklist

| Agriculture | | | | |
|---|---|---|---|---|
| Permitted CAFOs | 0 | 1 | 3 | 5 |
| Crop Production (Cropland or Dry Land) | 0 | 1 | 3 | 5 |
| Drains | 0 | 1 | 3 | 5 |
| Irrigated Crop Production (Irrigation Equip) | 0 | 1 | 3 | 5 |
| Permitted Aquaculture | 0 | 1 | 3 | 5 |
| Other: | 0 | 1 | 3 | 5 |
| **Rangeland** | | | | |
| Livestock Grazing or Feeding Operation | 0 | 1 | 3 | 5 |
| Rangeland Grazing (dispersed) | 0 | 1 | 3 | 5 |
| Other: | 0 | 1 | 3 | 5 |
| **Industrial/ Municipal** | | | | |
| Industrial Stormwater Discharge (permitted) | 0 | 1 | 3 | 5 |
| Storm water Runoff due to Construction | 0 | 1 | 3 | 5 |
| Industrial Point Source Discharge | 0 | 1 | 3 | 5 |
| Landfill | 0 | 1 | 3 | 5 |
| Municipal Point Source Discharge | 0 | 1 | 3 | 5 |
| On-Site Treatment Systems (Septic, etc.) | 0 | 1 | 3 | 5 |
| Pavement/ /Impervious Surfaces | 0 | 1 | 3 | 5 |
| Inappropriate Waste Disposal | 0 | 1 | 3 | 5 |
| RCRA/Superfund Site | 0 | 1 | 3 | 5 |
| Residences/Buildings | 0 | 1 | 3 | 5 |
| Site Clearance (Land Development) | 0 | 1 | 3 | 5 |
| Urban Runoff/Storm Sewers | 0 | 1 | 3 | 5 |
| Power Plants | 0 | 1 | 3 | 5 |
| Other: | 0 | 1 | 3 | 5 |
| **Resource Extraction** | | | | |
| Abandoned Mines (Inactive)/Tailings | 0 | 1 | 3 | 5 |
| Acid Mine Drainage | 0 | 1 | 3 | 5 |
| Active Mines (Placer/Potash/Other -- circle) | 0 | 1 | 3 | 5 |
| Oil/Gas Activities (Permitted/Legacy – circle) | 0 | 1 | 3 | 5 |
| Reclamation of Inactive Mines | 0 | 1 | 3 | 5 |
| Other: | 0 | 1 | 3 | 5 |
| **Roads** | | | | |
| Bridges/Culverts/RR Crossings | 0 | 1 | 3 | 5 |
| Low Water Crossing | 0 | 1 | 3 | 5 |
| Paved Roads | 0 | 1 | 3 | 5 |
| Gravel or Dirt Roads | 0 | 1 | 3 | 5 |
| Other: | 0 | 1 | 3 | 5 |

| Silviculture | | | | |
|---|---|---|---|---|
| Logging Ops – Active Harvesting | 0 | 1 | 3 | 5 |
| Logging Ops – Legacy | 0 | 1 | 3 | 5 |
| Fire Suppression (Thinning/Chemicals) | 0 | 1 | 3 | 5 |
| Other: | 0 | 1 | 3 | 5 |
| **Hydromodifications** | | | | |
| Channelization | 0 | 1 | 3 | 5 |
| Dams/Diversions | 0 | 1 | 3 | 5 |
| Draining/Filling Wetlands | 0 | 1 | 3 | 5 |
| Dredging | 0 | 1 | 3 | 5 |
| Irrigation Return Drains | 0 | 1 | 3 | 5 |
| Riprap/Wall/Dike/Jetty Jack -- circle | 0 | 1 | 3 | 5 |
| Flow Alteration (from Water Diversions/Dam Ops – circle) | 0 | 1 | 3 | 5 |
| Highway/Road/Bridge Runoff | 0 | 1 | 3 | 5 |
| Other: | 0 | 1 | 3 | 5 |
| **Miscellaneous** | | | | |
| Angling Pressure | 0 | 1 | 3 | 5 |
| Dumping/Garbage/Trash/Litter | 0 | 1 | 3 | 5 |
| Exotic Plant Species | 0 | 1 | 3 | 5 |
| Fish Stocking | 0 | 1 | 3 | 5 |
| Hiking Trails | 0 | 1 | 3 | 5 |
| Campgrounds (Dispersed/Defined – circle) | 0 | 1 | 3 | 5 |
| Surface Films/Odors | 0 | 1 | 3 | 5 |
| Pesticide Application (Algaecide/Insecticide) | 0 | 1 | 3 | 5 |
| Waste From Pets (high concentration) | 0 | 1 | 3 | 5 |
| Other: | 0 | 1 | 3 | 5 |
| **Habitat Modification** | | | | |
| Exotics Removal | 0 | 1 | 3 | 5 |
| Incised | 0 | 1 | 3 | 5 |
| Mass Wasting | 0 | 1 | 3 | 5 |
| Restoration | 0 | 1 | 3 | 5 |
| Other: | 0 | 1 | 3 | 5 |
| **Natural Disturbance or Occurrence** | | | | |
| Waterfowl | 0 | 1 | 3 | 5 |
| Drought-related Impacts | 0 | 1 | 3 | 5 |
| Watershed Runoff Following Forest Fire | 0 | 1 | 3 | 5 |
| Recent Bankfull or Overbank Flows | 0 | 1 | 3 | 5 |
| Wildlife other than Waterfowl | 0 | 1 | 3 | 5 |
| Other Natural Sources: | 0 | 1 | 3 | 5 |

### Legend – Proximity Score

| | | | |
|---|---|---|---|
| Activity believed to be Absent | 0 | Activity observed or known to be present within 1 km of the channel | 3 |
| Activity believed to be present in Watershed | 1 | Activity observed or known to be present in the riparian zone | 5 |

# APPENDIX B
# PUBLIC PARTICIPATION FLOWCHART

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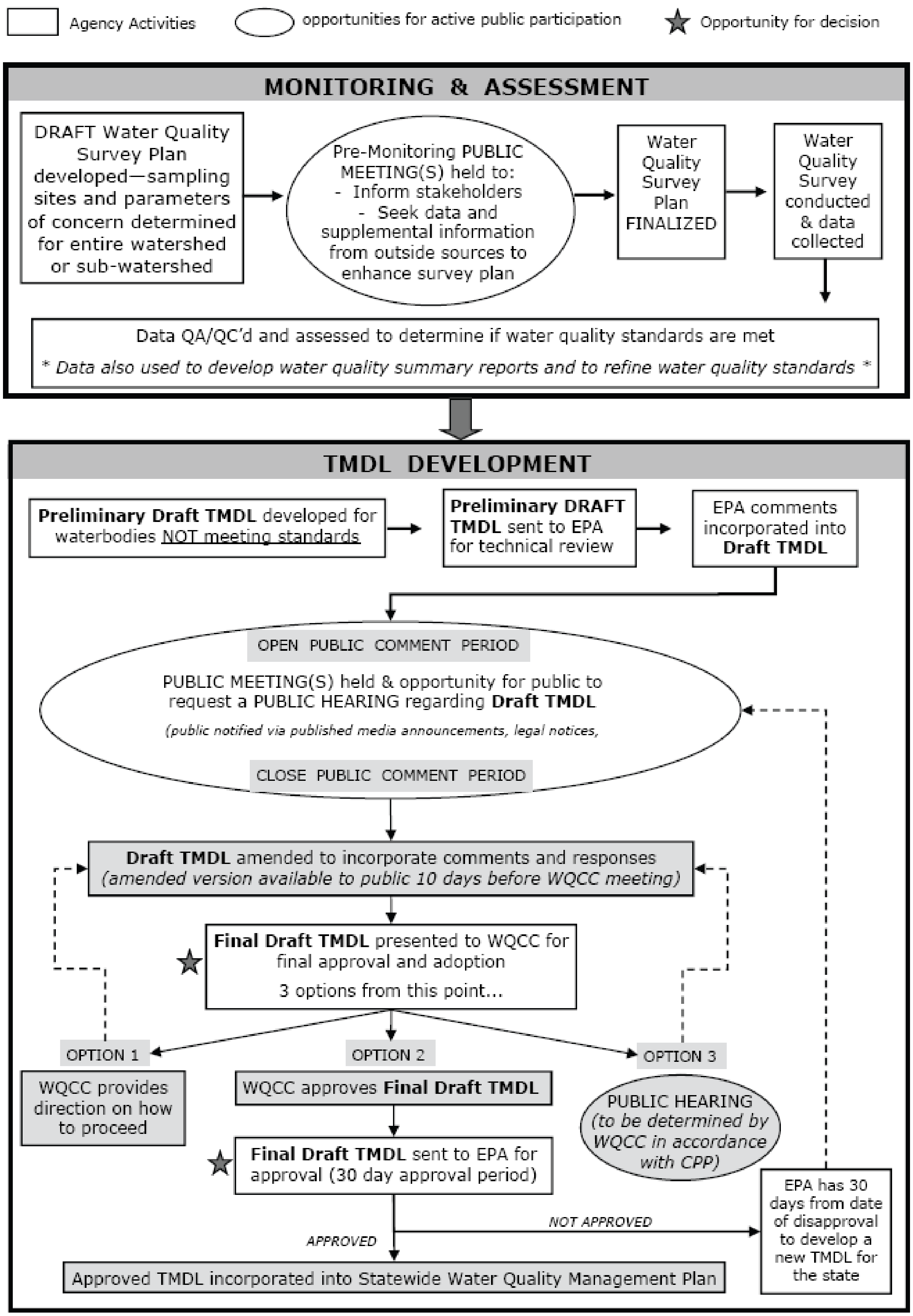
## Monitoring, Assessment, & TMDL Development Process



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# APPENDIX C
# RESPONSE TO COMMENTS

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**Comment Set A: David Foote**
**Provided at the public meeting in Tucumcari, NM on June 15, 2011.**

## Surface Water Quality Bureau
NEW MEXICO ENVIRONMENT DEPARTMENT

### Public Comment Card

Meeting Date: 6/15/2011
Comments Regarding: Total lack of baseline information

*OPTIONAL INFORMATION :

*Name: David Foote *Affiliation: US citizen
*E-Mail: davidtoni@plateautel.net
*Mailing Address: 4343 Quay Road 63 Tucumcari NM 88401

***Comments must be submitted in writing in order to be included in the public record. Please provide comments in the space below (use back if necessary):***

The total disregard or utilization of any historical data and the disregard of the lack of perinial flow in the streams and "rivers" mentioned, would place this entire process in question. I would suggest that the establishment of say a 10 year study to establish some base line figures would be in order.

Turn comment card in tonight or mail / fax:

TMDL Coordinator 5469
Surface Water Quality Bureau, P. O. Box ~~26110~~ Santa Fe, NM 87502
Phone: (505) 827-0187; Fax: (505) 827-0160

*SWQB Response:*
*Thank you for your comment. SWQB appreciates your concern over these TMDLs; however SWQB respectfully disagrees with your comment for the following reasons:*

*The Monitoring and Assessment Section of the Surface Water Quality Bureau (SWQB) conducted a water quality survey of the Canadian River Watershed between March and November, 2006. This water quality survey included 35 sampling sites. Only two sites (Tinaja Creek near Raton and Conchas River at NM 104) were dry during most of the survey or were flowing only in response to storm events. All other sites were able to be sampled during the monthly site visits.*

*Data are assessed against water quality criteria found in the* New Mexico Standards for Interstate and Intrastate Surface Waters (Standards) *to determine if a stream is meeting established standards. Typically, the most recent 5 years worth of data are used to assess a stream, including outside sources of available data that are solicited via public notice before the assessment process begins. Quality data received through this solicitation may be used to confirm an existing impairment, confirm the absence of impairment, or initiate a new listing of impairment of a particular stream. In other words, if SWQB receives additional quality data from the USGS, contractors, tribes, and/or watershed or citizen groups then these data may be incorporated into the assessment process.*

*Once a stream is identified as impaired (i.e., not meeting water quality standards) a TMDL is developed to address that impairment. TMDLs are calculated by multiplying the water quality criteria (taken from the* Standards*) by the critical flow value (see paragraphs below).*

*Historical flow data, if available, are used to calculate the critical flows used in the TMDL. There are four active USGS gaging stations in the Canadian River: the Canadian River near Taylor Springs, the Canadian River near Sanchez, the Canadian River at Logan, and Revuelto Creek near Logan. The periods of record for these gages range from 48 years to 76 years. As appropriate, these gage records were used during the TMDL development process.*

*It is often necessary to estimate a critical flow for a portion of a watershed where there is no active USGS flow gage. Critical flows for ungaged streams in the Canadian Watershed were calculated using the statewide equation described by Waltemeyer (2002). Waltemeyer's statewide analysis is based on data from 50 gaging stations with non-zero discharge and periods of record ranging from 6 to 92 years.*

**Comment Set B:**

**From:** Bobbye Rose [mailto:manager@cityoftucumcari.com]
**Sent:** Friday, July 08, 2011 1:27 PM
**To:** Henderson, Heidi, NMENV
**Cc:** Ed DuBois, Jr.; J. Ramirez; Doug Powers; M. Cherry
**Subject:** City of Tucumcari


TUCUMCARI

**PO Box 1188, Tucumcari, NM 88401**
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**www.cityoftucumcari.com**


July 7, 2011

Heidi Henderson
TMDL Coordinator
Surface Water Quality Bureau
1190 St. Francis Drive
P.O. Box 5469
Santa Fe, New Mexico 87502

**RE: Responses to the Canadian River Draft TMDL**
**City of Tucumcari Wastewater Treatment Facility**

Dear Ms. Henderson,

This letter is in response to the public comment portion of the Canadian River Draft TMDL and the associated public meeting on June 15, 2011 in Tucumcari.

The City of Tucumcari has taken a proactive approach to the upgrades at the Wastewater Treatment Facility (WWTF) including the addition of an enormous amount of debt along with increasing sewer rates to finance the associated projects over the past few years. Since the last major upgrades were in the early 1980's, a Preliminary Engineering Report was completed in 2006 by HDR Engineering. The first improvements made were the Solids Handling and Headworks Project, which was completed in the spring of 2010 at the cost of approximately $4.2 million. Following that project, the current process upgrade to a new activated sludge plant started using American Recovery and Reinvestment Act (ARRA) funding. At this time, the project is about 80% complete and anticipated to be online in fall of 2011, at an approximate cost of $8 million. Currently, the City is at its maximum funding capability and unable to take on additional loans in association with the new TMDLs.

*<u>SWQB Response</u>:*

*We appreciate the City's commitment to improving water quality by upgrading the wastewater treatment plant. In regards to your financial concerns, SWQB recognizes the City's unique situation and is recommending a phased implementation of this TMDL. In response we have specifically developed a first phase of implementation that should result in no or minimal additional financial burden to the City (see Table 5.7 and Section 7.1). This approach is largely based on the proposal outlined by the City at the end of this letter. Water quality will be evaluated by SWQB during the next watershed survey in 2015, after Phase 1 has been implemented, to assess the effectiveness of the new wastewater treatment system and other management strategies.*

*Several sources of funding exist to address impairments discussed in the TMDL document. For point source pollution, the New Mexico Environment Department's Construction Program Bureau (NMED/CPB) assists communities in need of funding for WWTP upgrades. Tucumcari is eligible for a Clean Water State Revolving Fund (CWSRF) and would likely qualify for a reduced interest rate of 1% to 2% with a repayment period of up to 20 years; however the City did not apply for CWSRF this year and they are not on the 2012 integrated projects priority list (IPPL) at this time. NMED/CPB encourages the City of Tucumcari to apply as soon as possible so that the City may be placed on the IPPL and be eligible to possibly receive funding in 2013. In addition to the CWSRF program CPB offers a Rural Infrastructure Revolving Loan Program or RIP. The base rate is 3% with a repayment schedule of up to 20 years. Applications for the RIP Loan are accepted throughout the year.*

*For nonpoint source pollution, monies are available through the Clean Water Act (CWA) §319(h) for on-the-ground projects aimed at improving surface water quality and associated habitat, such as implementing best management practices that reduce runoff and/or capture stormflow. CPB can also provide matching funds for appropriate CWA §319(h) projects using CWSRF monies. SWQB is committed to work with CPB, the City of Tucumcari, and EPA to help provide the necessary resources to implement this TMDL and improve water quality.*

There are a few other issues with the draft TMDL. This is a very restrictive TMDL which appears to be based on EPA Ecoregion Criteria for establishing the in-stream TP and TN targets for Pajarito Creek in combination with a low flow 4Q3 stream condition. There is no cause and effect relationship developed in the TMDL that links Ecoregion Criteria of TP of 0.03 mg/L and TN of 0.450 mg/L with restoration of any beneficial uses of the stream. The ambient concentrations in Pajarito Creek are above these ecoregion criteria levels at TP 0.051 mg/L and TN 0.693 mg/L, so there's no assimilative capacity available in the receiving water. There's no identification of the limiting nutrient in the creek or discussion of the critical water quality condition and whether it's a low flow, seasonal, or annual condition that needs to be restored, and no linkage between the targets selected and the restoration of beneficial uses.

*<u>SWQB Response</u>:*

*The State of New Mexico has narrative criterion to determine nutrient impairment, which states:*

> *"Plant nutrients from other than natural causes shall not be present in concentrations which will produce undesirable aquatic life or result in a dominance of nuisance species in surface waters of the state."*

*This narrative criterion can be challenging to assess because the relationships between nutrient levels and impairment of designated uses are not defined. Therefore, SWQB (with assistance from EPA and* *the U.S. Geological Survey), developed a Nutrient Assessment Protocol to assist in meeting these challenges. The protocol addresses both cause (total nitrogen and total phosphorus) and response variables (dissolved oxygen, pH, and chlorophyll-a) and uses a weight-of-evidence approach. Analysis of existing data and literature reviews were utilized to develop impairment threshold values (which are then used as the TMDL target concentrations) for each of the cause and response variables to translate the narrative nutrient criterion into quantifiable endpoints.*

*SWQB believes that a TMDL should be written to targets that are protective of the stream and scientifically defensible however there should also be recognition of the limits of technology for nutrient removal. Even though the limits of wastewater treatment technology preclude the attainment of the target concentrations defined in this TMDL (TP of 0.03 mg/L and TN of 0.45 mg/L), advanced treatment would significantly reduce the load of TP and TN that is introduced into the stream. In addition,* ***SWQB recommended a phased strategy to implement this TMDL*** *(see Figure 5.1 and Table 5.7) recognizing that the in-stream targets are currently unachievable with current nutrient removal technology; however in response to the City's concern over the Phase 1 limits proposed in the Public Comment Draft TMDL and in recognition that the City has already begun construction on the new facility,* ***SWQB has modified the Phase 1 effluent limits from 0.1 mg/L TP to 1.0 mg/L TP and from 3.0 mg/L TN to 8.0 mg/L TN.*** *After implementation of the new nutrient removal system, as well as the enhanced land application process, and given enough time to allow the aquatic to system to respond, SWQB will reevaluate the condition of Pajarito Creek. At that time, if the waterbody is still impaired for plant nutrients and there is no substantial improvement observed in the water quality, the WWTP would be required to enhance the treatment of the effluent by adding more effective treatment or find other means of disposal.*

*SWQB found that concentrations of nitrogen and phosphorus at NM 104 (upstream from the WWTP discharge point) are greater than the in-stream target concentrations indicating that nutrient enrichment is not strictly a point source problem. Other sources are contributing to the nutrient load in Pajarito Creek, therefore the impairment should be addressed through the NPDES permitting process to reduce contributions from the WWTP as well as through Best Management Practices (BMPs) to reduce contributions from the surrounding landscape.*

*In regards to the limiting nutrient of the stream, nitrogen to phosphorus ratios (TN:TP) have been used to infer nutrient limitation in terms of which of these nutrients most likely limits algae growth in a system. This is based on the relative requirement for each nutrient by different types of plants. Higher ratios, particularly above 17, infer P limitation for algae, and lower ratios, particularly below 10, infer N limitation. Nitrogen and phosphorus are considered to co-limit algal growth in waterbodies where TN:TP ratios occur between 10 and 17 (Smith 1998[1]). Data collected by SWQB suggest that a combination of N and P typically limits algal growth in Pajarito Creek (Table C-1).*

[1] *Smith, V.H. 1998. Cultural eutrophication of inland, estuarine, and coastal waters. In: M.L. Pace and P.M. Groffman (eds.), Limitation and frontiers in ecosystem science. Springer-Verlag, New York, NY. p. 7–49.*

**Table C-1. Limiting nutrient analysis in Pajarito Creek based on N:P ratios**

| Pajarito Creek (Canadian River to headwaters) | | TN (mg/L) | TP (mg/L) | N:P | Limiting Nutrient |
|---|---|---|---|---|---|
| Pajarito Creek above the Canadian River* | 4/17/2002 10:00 | 0.299 | 0.068 | 4 | Nitrogen |
| Pajarito Creek at NM 104 | 5/7/2002 17:00 | 0.419 | 0.036 | 12 | Co-limited |
| Pajarito Creek at NM 104 | 3/20/2006 13:19 | 0.760 | 0.035 | 22 | Phosphorus |
| Pajarito Creek at NM 104 | 4/11/2006 12:30 | 0.630 | 0.071 | 9 | Nitrogen |
| Pajarito Creek at NM 104 | 5/9/2006 16:40 | 0.750 | 0.062 | 12 | Co-limited |
| Pajarito Creek at NM 104 | 6/21/2006 17:21 | 0.850 | 0.073 | 12 | Co-limited |
| Pajarito Creek at NM 104 | 7/17/2006 19:30 | 0.970 | 0.035 | 28 | Phosphorus |
| Pajarito Creek at NM 104 | 8/9/2006 19:00 | 0.830 | 0.043 | 19 | Phosphorus |
| Pajarito Creek at NM 104 | 9/7/2006 17:20 | 0.930 | 0.056 | 17 | Co-limited |
| Pajarito Creek at NM 104 | 10/4/2006 9:20 | 0.490 | 0.031 | 16 | Co-limited |
| | **AVERAGE** | **0.693** | **0.051** | **14** | **Co-limited** |

** Notes in the database indicate that this sample was collected at NM 104*

The effect of TMDLs formulated in this manner is that the selected in-stream targets for TP and TN based on ecoregion criteria essentially become end-of-pipe effluent limits. Both the TP and TN values selected based on ecoregion criteria are at, or below, the limits of treatment technology if applied as end-of-pipe limits. So, in effect, the assumption made in selecting the ecoregion criteria results in a TMDL that requires zero discharge to surface water. This may be very deleterious to maintaining streamflows during low flow periods because if forces the treated effluent out of the stream.

The effluent from the plant discharges to Breen's Pond then to No Name Creek which then goes into Pajarito Creek. However, no actual samples were taken downstream of the WWTF in Pajarito Creek. An accurate reading or interpretation of the effluent can not be made if the actual discharge point is not tested.

*SWQB Response:*
*The TMDL targets are essentially end-of-pipe limits because the critical dilution of the plant is 100%. The issue is that there is no dilution capacity from the receiving steam especially since there are upstream sources that are elevating nutrient concentrations in the stream prior to the discharge point.*

*SWQB uses a weight-of-evidence approach to nutrient assessment that evaluates various conditions in the steam and includes both cause (nitrogen and phosphorus) and response (dissolved oxygen, pH, chlorophyll-a) variables. Taking water quality samples downstream of the WWTP would not change the impairment determination or TMDL development process for Pajarito Creek.*

*TMDLs should reflect a margin of safety based on the uncertainty or variability in the data, the point and nonpoint source load estimates, and the modeling analysis. For the Pajarito Creek Nutrient TMDL, the margin of safety was developed using a combination of conservative assumptions and explicit recognition of potential errors. Section 5.7 in the TMDL document details these assumptions, one of which is calculating the wasteload allocation and point source loading estimates using the design capacity of the plant.*

Furthermore, currently no effluent is discharged from Breen's Pond. The City's effluent is discharged to Breen's Pond, but the landowner Chipper Breen, takes all the effluent before it overflows into No Name Creek. Mr. Breen has installed a pipeline below the overflow elevation, bypassing all the effluent to irrigate his property. Joe Ramirez, the City's Wastewater Superintendent, visited Breen's Pond on several occasions this summer and can verify the information. Mr. Ramirez can provide you with additional photo documentation if necessary. While the effluent has been 100% reused in recent years, the City plans to retain the discharge to No Name Creek.

*SWQB Response:*
*According to the City's permit application from 2007, the WWTP discharges to Breen's Pond, thence to No Name Creek, thence to Pajarito Creek. SWQB recognizes that the City has greatly increased its reuse and that direct discharge to No Name Creek is greatly reduced, even to the point of no surface discharge during recent years. With that said, if the City intends to retain its NPDES discharge permit to Breen's Pond, it is SWQB's opinion that EPA in its permit would still recognize this as a potential discharge to Pajarito Creek due to the possibility of both a significant groundwater connection and the fact that during wet periods it may not be possible to contain water within Breen's Pond. Given this, SWQB believes it is in the best interest of the City to incorporate a WLA for the Tucumcari WWTP into the Pajarito Nutrient TMDL that allows for continued discharge under an NPDES permit.*

The treatment plant was designed by HDR Engineering to meet 10 mg/L total inorganic nitrogen (ammonia plus nitrate plus nitrite). If the effluent dissolved organic nitrogen is 1-2 mg/L and particulate organic nitrogen 2-4 mg/L, then the plant should be able to meet 13-16 mg/L TN. The plant is not designed for phosphorus removal and is not expected to remove any significant amounts of phosphorus, above and beyond that required to support the biological processes.

Once the new plant improvements are fully operational, we will be in a better position to establish the actually performance capability and effluent characteristics. We anticipate that the plant may perform better on nitrogen removal; but if simultaneous phosphorus removal is required, the tradeoff between nitrogen and phosphorus removal needs to be established for this facility since nitrogen removal performance may be lessened.

We would like to propose the following approach:

- Bring the new plant online (Fall 2011)
- Optimize the process for nitrogen removal during the initial year of operation (Jan – Dec 2012) and determine the degree of nitrogen removal achievable with the current plant (anticipated to be 10-15 mg/L TN)
- Continue to monitor plant performance and influent characteristics to evaluate process options for future nutrient limits for another year to obtain operational and design data for future improvements (Jan – Dec 2013).
- Evaluate the options for phosphorus and nitrogen removal to achieve a combined 10 mg/L TN and 1 mg/L TP on an average annual basis. Prepare an updated facilities plan to evaluate and select the preferred approach to treatment and effluent management (June 2014).
- Propose seasonal limits to Breen's Pond from April 1st to October 1st, which also corresponds with the Arch Hurley Irrigation season. No discharge will occur from Breen's

Pond to No Name Creek/Pajarito Creek during this time. All effluent will be used as part of the Tucumcari Reuse Project or used by Mr. Breen on his property.

Depending on the final TMDL, the Schedule of Compliance will be different. However, at this time, we would like to ask for a time extension based on the above approach. Since the TMDL is based on results from the 2006 survey assessment, before any of the recent treatment plant improvements were made, we request that the effluent be re-assessed in 2016 by the NMED/EPA. This would allow the upgraded plant to be in operation long enough to gather sufficient performance data to accurately establish what effluent limits can be met reasonably for the subsequent NPDES permit.

*SWQB Response:*
*Thank you for providing some proposals for implementing this TMDL. In recognition of the fact that construction on the new plant is approximately 80% complete, **SWQB updated Table 5.7 in the TMDL to recommend less stringent effluent limits.** The Phase 1 limits from Table 5.7 are very similar to the limits proposed above (8.0 mg/L TN and 1.0 mg/L TP) and would be expected to reduce nitrogen loading from the WWTP by roughly 50% and phosphorus loading by almost 80% (average effluent concentrations in 2006 without a nutrient removal system were 16 mg/L for TN and 5.4 mg/L for TP).*

***SWQB has also provided more detail in the implementation section of the TMDL, Section 7.1 – Point Sources and NPDES Permitting, which discusses several implementation options.** SWQB would specifically like to direct the City to review Option 3 that suggests seasonal limits and re-use applications similar to your proposal.*

*It is the policy of the EPA to allow schedules of compliance in NPDES permits where facility modifications need to be made to meet new water quality based requirements. A compliance schedule will be included in the new NPDES permit to meet any new effluent requirements.*

In addition, the City of Tucumcari and HDR would be very receptive to a meeting and/or conference call to discuss the proposed TMDL requirements.

*SWQB Response:*
*SWQB appreciates the offer from the City of Tucumcari to discuss their comments in detail and SWQB's proposed responses. On Wednesday August 3rd, representatives of the SWQB met with City officials and HDR, their consultant on the new WWTP facility. In addition, representatives of the GWQB and the CPB were able to attend by phone. A total of 16 persons attended the meeting.*

*The City requested that SWQB include a reference to the new WWTP design capacity (1.2 MGD, an increase from the current 0.9 MGD) in Tables 5.5 and 5.7. The SWQB agrees to include a reference to the increase in the design capacity. However SWQB feels that these tables should also reflect the current situation and the design of the current WWTP. The state Water Quality Management Plan (WQMP) allows for TMDLs to be increased based on increased capacity at the TMDL target concentration, without revision of the TMDL document. In the case of this TMDL the stream target concentration and the WLA concentration are the same as there is essentially no dilution provided by Pajarito Creek. As such an increase in discharge volume is allowed, however this will result in no change in the concentration limits provided in the TMDL for the WLA. It should also be noted that* *during the NPDES permit renewal process, an increase in the design flow of the WWTP will require an Antidegradation Review for all pollutants not included in this TMDL.*

*The City and HDR, requested SWQB add information in Section 5.1 of the Plant Nutrients TMDL (which is subsequently referenced in Section 7.1 of the Implementation section) about how the stream will be reassessed – specifically what the targets are for the cause variables of TN and TP concentration and the response variables of diel DO variability and periphyton chlorophyll a concentration.*

*A significant amount of the discussion during the meeting focused on the details of the proposed options for NPDES permit implementation provided in section 7.1 – specifically the proposed nutrient concentration limits. HDR and the City commented that weekly and daily effluent limits for nutrients are overly restrictive and unnecessary to protect water quality from nutrient effects – as nutrients, unlike toxics, do not have an immediate impact on water quality. They note that TMDLs and permit limits can be expressed in terms of annual mass loadings noting specifically the following Federal Regulations allow such flexibility:*

*40 CFR 130.2(i) TMDLs can be expressed in terms of either mass per time, toxicity, or other appropriate measure.*

*40 CFR122.45 (d) Continuous discharges. For continuous discharges all permit effluent limitations, standards, and prohibitions, including those necessary to achieve water quality standards, shall unless impracticable be stated as:*
*(1) Maximum daily and average monthly discharge limitations for all dischargers other than publicly owned treatment works; and*
*(2) Average weekly and average monthly discharge limitations for POTWs.*

*Regarding TMDLs – This TMDL is appropriately expressed as mass/time calculated as a daily load for the critical flow. The reason for this is that nutrient impairments are caused by the concentration of nutrients in the water not an annual loading. In order to be protective of water quality SWQB must insure appropriate concentrations at the critical flow. As such an annual load for a stream impairment will not be protective of water quality.*

*Regarding NPDES Permit Limits - SWQB agrees that nutrients are different from toxic pollutants. The EPA in other Regions has agreed at times that the implementation of discharge limits as daily or monthly averages for nutrients is "impracticable" and that annual limits are appropriate. It is important to note in cases[2] where EPA has approved annual limits they found it was appropriate because the "exposure period is very long" and the water body "of concern is far-field (as opposed to the immediate vicinity of the discharge)". Neither of these situations applies to Pajarito Creek. SWQB agrees that daily limits are not necessary to protect stream water quality and recommends in this TMDL that permit limits be expressed only as monthly limits. SWQB notes, as we have in Section 7.1 of the TMDL, that these options are only recommendations. EPA Region 6, in consultation with the City of Tucumcari and NMED staff, will determine which option to implement including the associated permit language and effluent limitations.*

*Finally, the City requested clarification on the expected timelines for the implementation of the TMDL and the resulting NPDES permit effluent limits. In response, the current NPDES permit expires and will*

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[2] Hanlon, James H., Director Office of Wastewater Management, Memorandum to Jon Capacasa, Director Water Permits Division, EPA Region and Rebecca Hammer, Director Chesapeake Bay Program Office, "Annual Permit Limits for Nitrogen and Phosphorus for Permits Designed to Protect Chesapeake Bay and its tidal tributaries from Excess Nutrient Loadings under the National Pollutant Discharge Elimination System," March 3, 2004.

*be up for renewal on January 31, 2013. The upcoming NPDES permit will incorporate this TMDL. This is detailed in Table 7.1 of the Implementation Section of the TMDL. The New Mexico Water Quality Standards 20.6.4.12(J) allows for compliance schedules in NPDES permits in order for permittees to meet effluent limits for water quality based pollutants on a case by case basis. The length of the compliance schedule will be determined by EPA during the permit renewal process. Typically monitoring requirements will be included in the permit during the compliance schedule before the effluent limits become required.*

If you have any questions or would like to discuss anything in further detail, please do not hesitate to call me at (575) 461-5996.

Sincerely,

Bobbye Rose
City Manager

Cc: Ed DuBois – HDR Engineering

MODRALL SPERLING

LAWYERS

Christopher P. Muirhead
505.848.1858
Fax: 505.848.1889
cmuirhead@modrall.com

July 7, 2011

**VIA E-MAIL**

Ms. Bobbye Rose, CMC
City of Tucumcari Municipal Offices
215 East Center
Tucumcari, New Mexico 88401-1188

***Re: City of Tucumcari, New Mexico Joint Utility System Debt Coverage***

Dear Bobbye:

Attached are debt service coverage numbers for the City's joint utility system as prepared by the City's financial advisor, RBC Capital Markets, LLC. These numbers reflect the financial health of the City's joint utility system and all outstanding debt with a lien on net system revenues. As indicated on the spreadsheet, the City will have debt service coverage of 1.30x in Fiscal Year 2012. Generally, a healthy utility system has debt service coverage of between 1.30x to 1.50x of net cash flow, after paying operation and maintenance expenses, sufficient not only to pay debt service on existing debt but to fund ongoing capital and renewal and replacement projects.

The City's net system revenues are currently sufficient to maintain compliance with 1.30x debt service coverage ratio. If the City were to see an increase in operation and maintenance expenses, or additional debt, it could result in debt coverage slipping below 1.30x coverage if there is not a corresponding increase in system revenues through higher demand or an increase in system rates. In short, in Fiscal Year 2012, the City does not have additional capacity in the joint utility system based on current net system revenues and outstanding debt. Please let me know if you'd like to discuss further.

Sincerely,

Chris Muirhead

ENCLOSURE
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## City of Tucumcari, New Mexico
Debt Service Coverage Analysis for Joint Water and Sewer

| Year Ending June 30 | 2006 | 2007 | 2008 | 2009 | 2010** | 2011** | 2012** |
|---|---|---|---|---|---|---|---|
| **Joint Utility - Net Revenues Available for Debt Service** | | | | | | | |
| Operating Revenues | $ 2,380,482 | $ 1,843,772 | $ 2,052,632 | $ 1,843,040 | $ 2,057,039 | $ 2,057,039 | $ 2,168,764 |
| Proposed Rate Increase | - | - | - | - | - | 111,725 | 15,000 |
| Total Operating Revenues | $ 2,380,482 | $ 1,843,772 | $ 2,052,632 | $ 1,843,040 | $ 2,057,039 | $ 2,168,764 | $ 2,183,764 |
| Total Operating Expenses | $ 1,807,108 | $ 2,023,220 | $ 2,143,651 | $ 1,990,707 | $ 1,793,435 | $ 1,811,369 | $ 1,829,483 |
| Operating income | $ 573,374 | $ (179,448) | $ (91,019) | $ (147,667) | $ 263,604 | $ 357,395 | $ 354,281 |
| Additional Revenues / Add Backs | | | | | | | |
| Interest income | $ 11,022 | $ 31,052 | $ 23,164 | $ 320,611 | $ 23,166 | $ 23,167 | $ 23,168 |
| Depreciation | 277,581 | 272,189 | 313,581 | - | - | - | - |
| Total Additional revenues / add backs | $ 288,603 | $ 303,241 | $ 336,745 | $ 320,611 | $ 23,166 | $ 23,167 | $ 23,168 |
| **Net revenues available for debt service** | **$ 861,977** | **$ 123,793** | **$ 245,726** | **$ 172,944** | **$ 286,770** | **$ 380,562** | **$ 377,449** |
| **Annual Debt Service** | | | | | | | |
| **Parity (Net Revenue Pledge)** | **$ 528,139** | **$ 2,899** | **$ 83,505** | **$ 114,343** | **$ 148,298** | **$ 147,904** | **$ 173,378** |
| **All Debt (parity plus sublien & GRT)** | **$ 555,240** | **$ 30,000** | **$ 110,606** | **$ 140,910** | **$ 174,865** | **$ 265,373** | **$ 290,847** |
| **Annual Debt Service Coverage** | | | | | | | |
| **Parity (Net Revenue Pledge)** | **1.63** | **42.70** | **2.94** | **1.51** | **1.93** | **2.57** | **2.18** |
| **All Debt** | **1.55** | **4.13** | **2.22** | **1.23** | **1.64** | **1.43** | **1.30** |
| **Outstanding Water and Wastewater Revenue Bonds** | | | | | | | |
| SERIES 1996 BONDS | $ 525,240 | $ - | $ - | $ - | $ - | $ - | $ - |
| NMFA 2001 DWRFL (MIGRT) ($475,200) | 27,101 | 27,101 | 27,101 | 26,567 | 26,568 | 26,569 | 26,569 |
| NMEID 2003 ($43,125) | 2,899 | 2,899 | 2,899 | 2,899 | 2,899 | 2,899 | 2,899 |
| RUS 2005 ($596,200) | - | - | - | - | 34,019 | 33,679 | 33,339 |
| RUS 2007A ($1,283,000) | - | - | 67,256 | 67,256 | 67,253 | 67,255 | 67,252 |
| RUS 2007B ($250,000) | - | - | 13,350 | 13,350 | 13,350 | 13,355 | 13,355 |
| RUS 2008A ($553,686) | - | - | - | 30,838 | 30,777 | 30,716 | 30,655 |
| NMFA WTB 5/1/09 ($350,000) | - | - | - | - | - | - | 2,699 |
| NMFA WTB 1/30/09 ($50,480) | - | - | - | - | - | - | 17,962 |
| NMFA WTB TDB ($100,000) | - | - | - | | - | - | 5,217 |
| RUS 2010A RUS Loan ($2,157,270) | - | - | - | - | - | 90,900 | 90,900 |
| Total | $ 555,240 | $ 30,000 | $ 110,606 | $ 140,910 | $ 174,865 | $ 265,373 | $ 290,847 |

** Projected

**Comment Set C:**

From: Doug Eib & Lyndsay Remerowski [mailto:remereibski@windstream.net]
Sent: Thursday, July 07, 2011 1:45 AM
To: Henderson, Heidi, NMENV
Subject: Public Comments on Canadian TMDL

*SWQB Response:*
*Thank you for your written comments. They are addressed by general topic in order below.*

**Comments on TMDL for Plant Nutrients on Pajarito Creek**

This TMDL suffers from a poorly executed sampling plan, a lack of data and unverified assumptions.

The sampling plan entered into the SWQB water quality database for the 2006 Canadian Survey, prior to the initiation of sampling in the spring of 2006, includes two stations on Pajarito Creek: One at NM 104, which appears in the list of sampling stations in the 2006 Water Quality Survey Summary for the Canadian River and Select Tributaries, as well as the TMDL, and a second station called Pajarito Creek above the Canadian River, which does not appear in the survey summary or the TMDL but was included in assessments for the 2008 303d/305b list.

The water quality database also includes information on the sampling scheduled for each station. In the case of Pajarito Creek above the Canadian River, the following text appears:
"USGS to sample on private property just above the confluence with Canadian 3X. Supplement that with 5X by SWQB at NM 104."

Driving directions are also entered for each station in the SWQB water quality database. For Pajarito Creek above the Canadian River, the following entry appears: "Tedious access on Bell Ranch".

*SWQB Response:*
*The sampling station "Pajarito Creek above the Canadian River" was not included in the survey summary report because it was not sampled by SWQB during the 2006 water quality survey. The original field sampling plan included water quality data collection at this location eight times; however after the field reconnaissance prior to the actual sampling, it was estimated that including this site would add an additional day of field work for two staff for each visit. Based on this, and prior to the knowledge of the nutrient impairment, it was determined not be worth this level of resources. The Bureau did contract with the USGS to sample Pajarito Creek above the Canadian River, which is not a regular water quality station for the USGS. The USGS was able to sample only one time in 2006. Data from this sampling event were included in the assessment of Pajarito Creek.*

The Tucumcari waste water treatment plant does not discharge directly into Pajarito Creek, but first into Breen's Pond, which in turn discharges into No Name Creek and finally into Pajarito Creek. During the 2006 survey effluent from the Tucumcari waste water treatment plant was sampled between the plant and Breen's pond; no samples were collected from the pond itself or No Name Creek.

No reasons are given in either the TMDL or the survey report for the failure of SWQB to complete it's planned sampling on Pajarito Creek at stations both above and below the confluence with No Name Creek. It has long been the practice in designing SWQB water quality surveys to bracket NPDES discharges with sampling stations, and to at least have a station downstream of discharges. Further evidence of this appears in the SWQB water quality database where one of the rationales entered for sampling Pajarito Creek above the Canadian is because it is "below the Tucumcari wwtp."

While access to Pajarito Creek above the Canadian River may be tedious, it is accessible by road and SWQB managed to do this on at least two occasions during it's 1988 survey of the Canadian River and it's Tributaries, as well as once during the aborted 2002 SWQB survey of the Canadian, and once again, early in the 2006 survey. Furthermore, SWQB staff often walk up to ten miles into remote areas to collect samples and water quality measurement in areas such as the Gila and Pecos Wilderness, and upper Gallinas watersheds.

*SWQB Response:*
*SWQB did sample Pajarito Creek above the Canadian River during its 1988 survey. Samples were collected on only two days 5/10/1988 and 5/12/1988*[3]*. Results for total phosphorous were 0.60 and 0.95 mg/L respectively whereas total nitrogen were 0.93 and 0.61 mg/L. While the age of this data precludes its use in water quality assessment, these values are well above the ecoregion criteria for this water (TP=0.03 mg/L and TN=0.45 mg/L) and thus consistent with the SWQB's finding of nutrient impairment. As for the 2002 survey, sampling notes indicate that Pajarito Creek was actually sampled at SR 104 (a.k.a. NM 104) not at Pajarito Creek above the Canadian as indicated in your comment. The 2006 field data from this site were collected during the USGS site visit and would not have been possible without the accompaniment of USGS personnel. SWQB usually makes an attempt to sample at historic locations, as well as sample above and below permitted discharges, but it is not always possible because of changes in land ownership, reductions in Bureau resources (people, time, and/or money), or shifts in priorities. For the reasons stated above, management and field staff eliminated "Pajarito Creek above the Canadian River" from the 2006 survey.*

The USGS sampled Pajarito Creek above the Canadian River for Total Phosphorus and Nitrate + Nitrite on 5/9/2006. SWQB sampled the effluent from the Tucumcari wastewater treatment plant on 5/10/2006. The following table compares results from the two stations:

| | Tucumcari WWTP Effluent | Pajarito Creek above the Canadian River |
|---|---|---|
| Total Phosphorus | 5.63 ppm | 0.26 ppm |
| Nitrate + Nitrite | 12 ppm | < 0.06 ppm |

[3] Smolka, L.R. 1988. Intensive Water Quality Survey of the **Upper and Middle Canadian River** in Colfax, Harding, Mora and San Miguel Counties, New Mexico, March 21-24, 1988. EID/SWQ-88/1. 53 p.

This comparison suggests that there is more than a 21-fold reduction in total phosphorus concentration from the point where effluent leaves the wastewater treatment plant to where it enters Pajarito Creek and an approximately 200-fold decrease in the concentration of Nitrate + Nitrite. The single nutrient sample collected by SWQB at Pajarito Creek above the Canadian River on April 17, 2002 had a total phosphorus concentration of 0.068 ppm and a Nitrite + Nitrite concentration of < 0.1 ppm, further indicating that there is a significant reduction in nutrient loading as effluent travels through Breen's pond. Whether the reduction in nutrient loading occurs through the polishing effect of vegetation or by means of ground water dilution, this comparison shows that there is a serious problem with assuming that effluent samples from the Tucumcari wastewater treatment plant are representative of the water quality below Breen's pond.

*SWQB Response:*
*SWQB is not assuming that effluent samples from the Tucumcari WWTP are representative of water quality below Breen's Pond. The TMDL targets are essentially end-of-pipe limits because the critical dilution of the discharge is 100% (NPDES permit #NM0020711), meaning the stream below the discharge point is entirely effluent dominated and there is no dilution provided by the stream. The issue is that there is no dilution capacity from the receiving steam especially since there are upstream sources that result in elevated nutrient concentrations in the stream, and nutrient impairment, prior to effluent from the Tucumcari WWTP reaching Pajarito Creek.*

*Additional discussion is warranted on the USGS data presented above. The USGS, based on the data from the one sampling event they were able to accomplish, found ammonia and organic nitrogen (a.k.a. TKN) to total 1.2 mg/L. So while nitrate for this sampling was quite low TN values were significantly higher, exceeding the ecoregion targets, and similar to the data collected in 1988. Taken together, all known data from downstream of No Name Creek is consistent with nutrient impairment for this water. Furthermore, it also shows an increase in concentration from the NM-104 site for both TN (1.2 versus 0.69 mg/L) and TP (0.26 versus 0.05 mg/L). See Table C1 above for results from the NM-104 location.*

SWQB needs to include the station located at Pajarito Creek above the Canadian River in the TMDL (Table 2.1 and Figures 2.1 and 2.2).

*SWQB Response:*
*Since this site was not sampled by SWQB in 2006 it will not be added to Table 2.1, Figure 2.1, or Figure 2.2 in the TMDL document.*

SWQB also needs to complete monitoring on Pajarito Creek above the Canadian River, not at NM 104, for plant nutrients according to current SOPs, and verify that the pollutant source summaries in Tables 5.11 and 5.12 of the TMDL are accurate for the Tucumcari waste water treatment plant. Furthermore, SWQB needs to document that plant nutrients from other than natural sources are producing undesireable aquatic life or dominance of nuisance species in Pajarito Creek above the Canadian River, before finalizing this TMDL and imposing numeric criteria on effluent limits.

*SWQB Response:*
*SWQB uses a weight-of-evidence approach to nutrient assessment that evaluates various conditions in the steam and includes both cause (nitrogen and phosphorus) and response (dissolved oxygen,*

*pH, chlorophyll-a) variables. This process was used at the monitoring location at NM-104 and documented that the level of nutrients in the stream were above ecoregion targets (i.e. concentrations are higher than would otherwise be expected from natural sources for a stream in this region) and that response variables indicated that elevated nutrient concentrations result in undesirable aquatic life. Taking water quality samples downstream of the WWTP would not change the impairment determination or TMDL development process for Pajarito Creek.*

*The pollutant source summary for Tucumcari WWTP was calculated by multiplying the effluent nutrient concentrations, the WWTP discharge, and a conversion factor to get the results in pounds per day. TMDLs are required to include a margin of safety based on the uncertainty or variability in the data, the point and nonpoint source load estimates, and the modeling analysis. For the Pajarito Creek Nutrient TMDL, the margin of safety was developed using a combination of conservative assumptions and explicit recognition of potential errors. Section 5.7 in the TMDL document details these assumptions. One of the conservative assumptions stated in this TMDL is the use of the WWTP discharge to calculate the point source loading even though the plant may not discharge continuously and may not be operating at full capacity 100% of the time. Taking water quality samples downstream of the WWTP would not change these calculations.*

*After implementation of a nutrient removal system and given enough time to allow the aquatic to system to respond, SWQB will reevaluate the condition of Pajarito Creek at NM-104 and other locations as access allows. The next scheduled monitoring date for the Canadian River watershed and Pajarito Creek is 2015. When water quality standards on Pajarito Creek have been achieved, the stream will be moved to the appropriate category on the 303(d) List of Assessed Surface Waters.*

**Comment Set D:**

**From:** Dan Campbell [mailto:dcampbell@cityofraton.com]
**Sent:** Monday, June 27, 2011 5:56 PM
**To:** Bearzi, James, NMENV
**Cc:** Henderson, Heidi, NMENV; Hogan, James, NMENV
**Subject:** RE: TMDL Extension

Mr. Bearzi,
The best option for Raton would be a 60 day extension; I have the TMDL issue on the Raton Water Board agenda for this week but the primary focus of the City is on the watershed damage. City management staff are on a 7 day a week schedule currently trying to prepare as much as possible prior to this year's monsoon season. The discharge from the Raton WWTP is the primary concern for us; the proposed requirements would be expensive to accomplish at a time when City funds are reduced and the catastrophic fire has raised serious questions concerning funding for watershed restoration. The WWTP discharges into Doggett Creek which then flows into Raton Creek so I would anticipate that would be our primary concern. Please let me know if I can provide any further information. Your consideration is appreciated.
Thanks,
Dan Campbell
Raton Water Works

**New Email Address:** dcampbell@cityofraton.com

Sincerely,
Dan Campbell
Raton Water Works

*SWQB Response:*
*NMED, in light of the extraordinary and unforeseen circumstances that the City of Raton (City) experienced as a result of the Track Fire and its effects on the local drinking water supply, has removed the E.coli and plant nutrient TMDLs for Raton Creek from the Canadian River document. These TMDLs will be reissued for a 30-day public comment period in September. Attached below was NMED's official response to the City.*

**NEW MEXICO**
**ENVIRONMENT DEPARTMENT**

***Surface Water Quality Bureau***

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Governor

JOHN A. SANCHEZ
Lieutenant Governor

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DAVE MARTIN
Secretary

RAJ SOLOMON, P.E.
Deputy Secretary

June 29, 2011

Dan Campbell
City of Raton Water Works
P.O. Box 99
Raton, NM 87740

**RE: EXTENSION REQUEST**
**TMDL FOR RATON CREEK**

Dear Mr. Campbell:

The New Mexico Environment Department (NMED) has received your June 27, 2011 e-mail request for a 60-day extension of the public comment period for the Canadian Part 2 Total Maximum Daily Loads (TMDL), specifically the *E.coli* and plant nutrient TMDLs for the Raton Creek (Chicorica to headwaters) assessment unit. NMED understands the extraordinary and unforeseen circumstances that the City of Raton (City) is experiencing concerning the Track Fire and its effects on the local drinking water supply.

NMED finds good cause for your request. In order to give the City sufficient time to review the TMDL document, NMED will take the following actions regarding the Raton Creek TMDLs. The 30-day public comment period for the Canadian River Part 2 TMDLs will close as scheduled on July 8, 2011 at 4 p.m. MDT. However, in response to your comment, the Raton Creek TMDLs will be removed from the Canadian River Part 2 document. The remainder of the Canadian Part 2 TMDL document will follow the existing timeline that includes presentation to the NM Water Quality Control Commission on August 9, 2011. The *E.coli* and plant nutrient TMDLs for the Raton Creek (Chicorica to headwaters) assessment unit will be released no sooner than 60 days from now (approximately early September) as a separate TMDL document for a 30-day public comment period.

Thank you for your continued cooperation with NMED concerning water quality in the Raton area. We look forward to rescheduling a public meeting to discuss the Raton Creek TMDLs during the new comment period starting in September. Please contact Heidi Henderson of my staff at (505) 827-2901 should you have any questions.

Sincerely,

James P. Bearzi
Chief
Surface Water Quality Bureau

cc: H. Henderson, NMED SWQB
J. Hogan, NMED SWQB